I 28: 149 1986/2

BUREAU OF MINES ★ UNITED STATES DEPARTMENT OF THE INTERIOR

Minerals and Materials

A Bimonthly Survey

April/May 1986

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MINERALS
and
MATERIALS

A Bimonthly Survey

April/May 1986

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald Paul Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

I

FOREWORD

Real output continued to expand worldwide in 1985, but at about two-thirds the rate of 1984. Inflation in the industrial countries continued to subside, but world unemployment rates grew. The U.S. economy grew at a 2.9% real annual rate in the first quarter of 1986, the largest increase since the third quarter of 1985. The composite index of leading indicators rose 1.5% in April, the third consecutive monthly increase, boding well for the second quarter. The mineral industry, however, with production and employment levels in many cases below those of last year, has not participated in the economic growth.

This issue of Minerals and Materials includes the text of an address by Ann Dore McLaughlin, Under Secretary of the Department of the Interior, before the May Coal Convention of the American Mining Congress in Pittsburgh. Also included is a paper presented by the president of the Nickel Development Institute before the Capital Metals Forum in Washington on current efforts to recapture old markets and develop new uses for nickel.

George White, Editor
July 15, 1986

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ACKNOWLEDGMENTS

Mineral information and data are provided by the commodity and country specialists, research personnel, and State mineral officers of the Bureau of Mines.

The Bureau of Mines will consider for publication authoritative articles on any facet of mineral resource development and use. The Bureau makes no commitment to publish such articles in advance of editorial and policy reviews.

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Mineral Data Series 33

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UNIT ABBREVIATIONS

$^{\circ}$C = degree Celsius
¢/lb = cent per pound
cm = centimeter
g/L = gram per liter
g/mt = gram per metric ton
h = hour
in = inch
kW·h = kilowatt hour
L = liter
lb = pound
lb/yr = pound per year
lt = long ton = 2,240 pounds
LTU = long ton unit: In sales of ores, concentrates or metals, a unit is 1% of the specified substance. A ton of 1% ore contains 1 unit. A ton of 48% manganese contains 48 units.
m = meter
m^3 = cubic meter
mt = metric ton = 2,204.6 pounds, 1,000 kilograms
mt/d = metric ton per day
mt/yr = metric ton per year
MW = megawatt
oz = troy ounce
oz/st = troy ounce per short ton
oz/yr = troy ounce per year
% = percent
ppm = part per million
st = short ton = 2,000 pounds
st/d = short ton per day
st/yr = short ton per year
yr = year

MINING TODAY—RISING TO THE CHALLENGE[1]

By Ann Dore McLaughlin[2]

The mineral industry today faces challenges that will test severely the ability, creativity, and flexibility of its managers, and I see these challenges reflected in this "compass-word"--competition. It is sometimes misunderstood. Editorial writers in Pravda probably have made a career out of purposely misunderstanding it. Cynics do not believe in it, describing competition as that which business applauds in inverse proportion to its distance from the business. But I know this audience understands competition. And you came to that understanding the hard way. You see more competition in one day than most businesses see in a lifetime. Because of the abundance of coal in this Nation, domestic producers have to compete vigorously among themselves for a market. Also, you have seen nuclear power swallow a portion of the traditional utilities market. You see some cement plants recently switching to natural gas. You see Australia, Canada, South Africa, and, most notably, Colombia offering coal in the international market at increasingly competitive prices. You see the price of oil dropping to the point that new coal-fired generating plants currently are uneconomical to build. You saw the highest barrier to overseas sales was not some foreign tariff, but our own bloated dollar!! So, there is nothing I can really tell you that you haven't learned first hand and long ago about this "compass-word" competition.

The most influential economist of our time is not Lord Maynard Keynes, with his brief for huge government spending, but an Austrian most Americans have never heard of--Joseph Schumpeter. Schumpeter saw the key to the effectiveness of a free economic system in what he called "creative destruction." By that he meant those endeavors that are unable to respond to changing needs and demands are destroyed by those more creative endeavors that see the needs and respond to them. The main thrust of his economic theory is that capitalist society owes its dynamism, its capacity to produce the most for the greatest number at the lowest price, to the creative destruction caused by the unremitting pressure of competition.

Anyone who has studied the way our system operated from the very beginning knows this to be a hard fact of industrial life. Even as Americans were sinking fortunes into canal building back in the early 1800's, most of the canals were doomed by the steam-powered train that seemed only able to huff and puff, but which one day turned around and blew the competition out of the water. And there must have been conventions of the American Society of Buggy Whip Makers even while Henry Ford was tinkering around in the barn.

It is clear from even these simple examples that it was not just something called "competition" that submerged the canals and whipped the buggies. It was rather two other aspects of any economic system that isn't stone dead or controlled by the state--which is really two ways of saying the same thing. Those elements were, first, a changing environment; and, second, an incapacity to see that the environment is changing, or an unwillingness to adjust, or both.

Now, what am I leading up to? That the coal industry is the equivalent to digging big ditches or making optional equipment for horse-drawn vehicles? Far from it. Even as we all see the clouds currently over the industry, we know that somewhere down the road, after much sweat, blood, and tears, you are going to be covered with sunshine. OPEC, like a volcano, is only sleeping. Nobody is creating more oil, worldwide demand is rising, and the oil being found is more expensive to drill. One of these days we will all be back once again on the coal standard. But, meanwhile, how do we get from here to there?

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[1] Remarks presented to the American Mining Congress Coal Convention, Pittsburgh, PA, May 5, 1986.

[2] Under Secretary of the U.S. Department of the Interior.

We have to realize that the environment has changed. The nuclear genie, despite the accident in the Ukraine, will not be pushed back into the atom. Concern about the environment will not go away. The demand for safe workplaces is not a sometime thing. And you are determined to be creative rather than destroyed. If you wish to rise to the challenge of competition and change, what must be done? Where do you begin? What do I suggest? Five keys. These five important, vital, interrelated steps are, first, look within; second, measure strength; and third, fourth, and fifth, commit yourselves to innovate, innovate, innovate. I suggest we begin the first step of looking within by establishing a quick economic sketch of the coal industry today as it has been explained to me.

Overall, U.S. coal production set a record in 1984, with 1985's total output down about 12%. The Department of the Interior staff has provided me with figures that indicate the long-term forecast for coal production predicts Eastern coal production to increase about 1% annually and Western coal production to increase 2.9% annually. These increases for the immediate future, I understand, can be absorbed by existing mine capacity.

Aggregate coal consumption in 1985 set a record, with consumption expected to fall off slightly (0.6%) this year. U.S. coal consumption is forecast to increase about 2% annually through the year 2000.

Coal exports were up 6 million tons in 1985, with 1986 exports projected to be lower. Coal imports, to date, are small but increasing.

Another area of general economic concern is the effect on the coal industry of reduced oil and gas prices. It is my understanding that with oil in the $13 to $15 per barrel range, it is still difficult to displace coal at existing facilities with oil. The main effect of lower oil prices, at this level, would be deferred construction of new coal-fired plants.

The price of oil and gas should be market determined. A factor that must be considered in this market-determined price is the security of sources for oil and other energy supplies. A corollary is, of course, the viability of a strong domestic minerals and energy industry as well. A strong domestic industry, however, should not be read as a non-competitive or a government-protected one.

Looking within, then, we find an industry facing substantial domestic competition from oil and, due to the now global reach of technology that has broadened the competitive base internationally, a potential competitive challenge from overseas producers. Traditional market expansion appears very modest, and profit margins are probably thin due to the modest growth potential and the ability of the industry at present to easily absorb this growth within existing production capacity.

In short, I see the industry approaching a period of heightened competition with all the potential for "creative destruction" noted by Schumpeter.

Strangely enough, Shakespeare has a useful message for us today about this all-important first key--look within. As you recall, in Julius Caesar Cassius tells Brutus that, "The fault ... is not in our stars, but in ourselves, that we are underlings." So, the place to begin is in our minds, convictions, attitudes--the psychological element. An organization or industry unconcerned with its own survival almost invites its own ultimate destruction. A flabby, laid-back organization of any kind is simply incapable of generating the enthusiasm and sense of sacrifice and purpose that lie at the heart of every successful, continuing enterprise. Back in 70 B.C. a famous Hebrew scholar conveyed this truth very well. He said, in part, "If I am not for myself, who will be for me?" So the key involves not dwelling on the problems I've mentioned, but on developing solutions that will lead to better days ahead.

Key number two, measuring strength, means recognizing that trends are not fate, that while competition is a hard fact of life, change can be harnessed. And change in the economic rules of the game is exactly what this Administration has in mind. Simply put, the Administration's goal is to restore a stable fiscal climate to promote long-term, noninflationary growth in the American economy. Our program consists of four basic parts:

1. A stringent budget policy to release resources to the private sector for investment and growth.
2. An incentive tax reduction policy to increase the supply and lower the cost of labor and capital--to encourage work effort, saving, and investment.
3. A noninflationary monetary policy to end inflation and reduce the higher interest rates and disincentives that inflation and the tax code combine to produce.
4. A regulatory reform program to reduce the enormous regulatory inefficiencies and costs that are holding back production and raising prices.

Monetary policy has been aimed primarily at reducing inflation, while fiscal policy (tax policy) has been aimed at promoting real growth.

Our aim was to balance a disinflationary monetary policy with a progrowth tax cut and spending-restraint policy in order to produce a smooth transition from stagflation to steady noninflationary growth with rising employment. Unfortunately, in both the monetary and fiscal areas, we were unable to bring about the necessary coordination. Sharp curtailment of monetary growth by the Federal Reserve in 1980 helped trigger the 1981 recession, and delays and alterations in the Administration's tax reduction plans by Congress reduced much of its effect. The result was that restrictive portions of the program came into place early and forcefully, and while the stimulative aspects of the program were delayed, the deficit grew.

Even with the problems of coordinating our monetary and fiscal programs, the economy today shows every sign of meeting the goal of increasing real growth while reducing inflation:

- Lower taxes, lower inflation, and higher productivity have raised real wage growth.
- The upward ratcheting of inflation has been ended.
- Unemployment has fallen and employment has risen at record rates.
- The stock market reflects increased confidence in the recovery.
- Interest rates have fallen significantly.

In short, growth is the name of the game. It is a self-reinforcing process. To hasten that process, the Congress must hold the line on spending and taxes, and the Federal Reserve must provide for a reasonable growth of money and credit.

In the short term, certain industries operating under the old rules face a period of painful readjustment. The coal industry, for example, would be negatively affected by current proposed tax reform packages developed by Congress and the Administration. If percentage depletion allowances and the accelerated cost recovery system and investment tax credit are eliminated, the costs to the mineral industry are likely to exceed the benefits reaped by lower labor costs and a lower corporate tax rate.

You and the other extractive mineral industries have very clearly made this point and need to continue to make it to the Congress and the Administration. But I am distressed by the reaction of some in the industry, who list a parade of horribles--starting with reduced investment in research and development--that sound very similar to a bureaucratic response to budget cuts. It is a bureaucratic truth that, if your office is faced with a budget cut, you respond by cutting the most important, most visible program you have. Thus, in the case of the National Park Service, the first action you take is reducing the hours or closing the doors to the Washington Monument.

This brings us to the main point of my comments--the challenges faced by the mineral industry, what the Department of the Interior is doing to assist the industry, and what the industry itself needs to consider--that is--my points three, four and five: the need to innovate, innovate, innovate.

On a level playing field we can compete with, or we can outcompete with, anyone if we build on our strength and cure our weaknesses. Government has already taken some major steps. Treasury Secretary Baker's leadership helped eliminate the dollar barrier to exports. Gramm-Rudman, however imperfect, is moving us toward a balanced budget and lower interest rates. Now it's up to industry. As Peter Scott, Chairman and CEO of Emhart Corp., put it in a recent Wall Street Journal op ed piece, "Our problems basically stem from management's myopia about technology and its fear of taking intelligent risks and diversifying. We managers are comfortable --too comfortable--in the sanctuary of the status quo. For two decades after World War II, we took our nation's industrial growth for granted. In our cozy maturity we looked at our remarkable manufacturing accomplishments and thought we saw, reflected, the whole course of our future. A guaranteed future."

"We were wrong. Dead wrong!" he adds. "We were wrong because we didn't see that what made America strong is our history of rejecting guaranteed futures. We became what we were, because we worked, and risked, and invented."

Scott observes, and I quote, "The answer to our problems does not lie in legislatures; no amount of legislative help--or tax bailouts--will resuscitate manufacturing anywhere in this nation. Competitiveness cannot be legislated. We have to become more competitive by changing our fundamental thinking."

While the problems of the manufacturing industry may not be directly comparable to those of the mining industry, it is again the general concept of complacency and reactive rather than proactive measures that needs to be addressed.

CBS Chairman Thomas Wyman tells us that to be effective today "... demands continual reconsideration of assumptions underlying old and familiar networks ... as well as the gathering and sorting of new information." For the American coal industry, this means, as it means for any industry that seeks to become more competitive, a commitment to innovation. There have been recent innovations in the coal industry, of course. Longwall mining is an example. And, as you well know, that innovation was imported. But where is the determination to conduct major, focused research and development? Where are the research institutes and centers, the intense search for new ways to mine coal, to use it, to break it down into new products, to contend through science, not legislation, with environmental constraints? To develop new markets? I know you can cite instances where R&D has been, and is, going forward. But much, if not all, appears to be on an ad hoc basis, done in some cases by the users of coal, with no center of gravity to hold it together, with no compass set by industry to give it direction.

For example, I am informed that the Bituminous Coal Research National Laboratory recently became a part of the University of Pittsburgh. I do not know the terms of this exchange nor the amount of control you, the industry, continue to have in directing the research effort. I do find the reason provided to me for the transfer--reductions in private funding--to be rather ominous, as R&D is a critical element in innovation. An environment for the coal industry's best minds needs to be created where they can consider new markets and market approaches and focus investment on research and development. This takes funding--your funding as an investment to give the industry the competitive edge it needs. I applaud the good record of individual companies which have formal cooperative arrangements with our Bureau of Mines Research Centers--but the bridge from our Bureau of Mines research and development work should be strengthened with your practical application.

The competition in the energy and mineral industries should be on a level playing field, or as close to level as one can get. The Department is a contributor to competitive fairness in several ways. On the domestic front we have initiated, in February of this year, a new Federal coal leasing program to reopen public lands to possible coal development. We share your concern with Section 3 of the Federal Coal Leasing Act and are working to limit its effect. We are considering alternatives to Section 7 of the Act that would allow more flexibility of the 10-year "produce-it-or-lose-it" provision. We are very concerned about EPA's regulatory role under the Clean Air Act with fugitive dust emissions from surface coal mines and we are working with them to ensure our concerns are addressed. We are also consulting with EPA on the issue of mining wastes classified as hazardous wastes.

Also, Secretary Hodel has promised to stabilize and bring consistency to the regulatory program at the Office of Surface Mining Reclamation and Enforcement. The Secretary has designated his Counselor, Earl Gjelde, to personally guide this effort.

On the international front, our Assistant Secretary for International Affairs, under the guidance of my Management by Objective process, is designing a plan that will plug the Interior Department into the project consideration process of the international development banks at an early level. This new channel will allow us to comment early in the process on the impact of loans for the development in other countries of minerals that already are in oversupply on the world market.

While not directly impacting coal, I have been involved in setting up a working group of Departmental and private entities to consider the new needs for exploration and mining in the Exclusive Economic Zone. We are not limiting ourselves to stretching existing laws such as the Outer Continental Shelf Lands Act or the Deep Seabed Mining Act, to shoe-horning the new needs into a structure not designed for them. We are analyzing the requirements that will facilitate mineral leasing in the EEZ, and will consider, if needed, a plan designed to meet those requirements.

The type of creative thinking so critical to your competitive edge is reflected in a recent Public Resource Foundation piece entitled "A Blueprint for Revision of the 1872 Mining Law." Do not misunderstand me here--I am not advocating a revision of that law today. In fact, the law was extremely effective in promoting hardrock exploration and mining. Time and circumstances have changed, however, and the law may be pinching a bit in areas not considered or imagined by the drafters of the 1872 statute. It is time, therefore, to think and to reflect on fundamental assumptions as this short study does.

In response to the continuing security issue of a strong domestic source of minerals and energy, Secretary Hodel recently reauthorized the important National Strategic Materials and Minerals Advisory Committee, also known as the Mott Committee. This Committee will work closely with the newly created Strategic Minerals Council to address the various issues that contribute to a strong domestic mineral industry.

While we, at Interior, are working to assist the mineral and coal industry in concert with the broader goals of the Reagan Administration, it goes without saying that none of the actions I have listed--either singly or taken as a whole--will be the key to a rejuvenated coal industry. The challenge you face is cause to look deep into the very fundamental assumptions about how you do business and where the future lies and to act, not react, to develop your competitive edge.

Earlier, I partially quoted an ancient Hebrew scholar by saying, "If I am not for myself, who will be for me?" In regard to when we should take and turn the five keys I've cited, let me complete that quotation as he did, "If not now, when?" And that is a challenge worthy of the best this great organization and industry can summon.

CURRENT AND FUTURE USES OF NICKEL: DEFENDING EXISTING MARKETS AND SEARCHING FOR NEW ONES[1]

by Johannes P. Schade[2]

Nickel is one of a number of metals that are experiencing declining markets. Downsizing and use of plastics in automobiles, reduced use of nickel coinage, and slow growth of the steel sink market have contributed to the recent history of no growth in nickel consumption. The Nickel Development Institute was founded by a majority of nickel producers in the western world to defend traditional markets for nickel and create new ones.

Introduction

Producers of goods all too often are unprepared to deal with the forces of new technology and changing consumer preferences. The "Tin Lizzy," developed by Henry Ford, had the reputation of a reliable, affordable product for nearly 20 years until competitors lured customers away with new technical concepts, stronger engines, a variety of colors, and more comfort. A more recent example of the forces of technological change are those exerted on the manufacturers of typewriters and carbon paper as word processors and modern copiers are capturing virtually the entire market. It is fatal to assume that there will always be a market for even the most apparently essential products. Products must be continuously defended in their existing applications, and new applications must be found, by early recognition of changes in technology and/or consumer preferences.

Defending the use of specific metals in fabricated products is difficult because metal producers are several steps away from the decisions that determine the future demand level for their products. But nickel producers can do much to slow or even reverse the erosion of the market for stainless steel kitchen sinks; producers of iron and steel can influence those who decide whether the automobile will be made from steel or plastics in the future; and manufacturers of copper can save the market for automotive radiators from the inroads made by aluminum.

Growth in Nickel Demand

The fundamental demand for nickel, or any "mature" raw material, is poor. Nickel and other metals have been left behind in the materials competition that is taking place in modern technology. Plastics and fiber composites enjoy substantial growth as these and other advanced materials are used as substitutes for traditional metals. Nickel experienced nearly zero growth in world consumption over the last 10 years. Generally, positive growth in the developing world was cancelled by negative growth in a number of industrialized countries like the United States, the United Kingdom, Sweden, and France (fig. 1).

As recently as 15 years ago North American-built cars contained up to 5 pounds of nickel per car in plated bumpers and trim. Downsizing and the use of elastomers, plastics, and painted bumpers in automobiles alone have eroded world production of nickel by about three percentage points. There are other examples of recent loss of markets for nickel. Only four countries still feature pure nickel coinage in their monetary system; organic coatings and engineering plastics are replacing nickel in the chemical process industry; and cupronickel applications in marine industries are challenged by substitutes such as titanium, plastics, and painted surfaces.

The use of nickel has increased in some applications. Nickel in stainless steel has gained acceptance in consumer durables and in architecture, and use of nickel alloys in the electronics industry has increased. But the market gains have barely kept pace with

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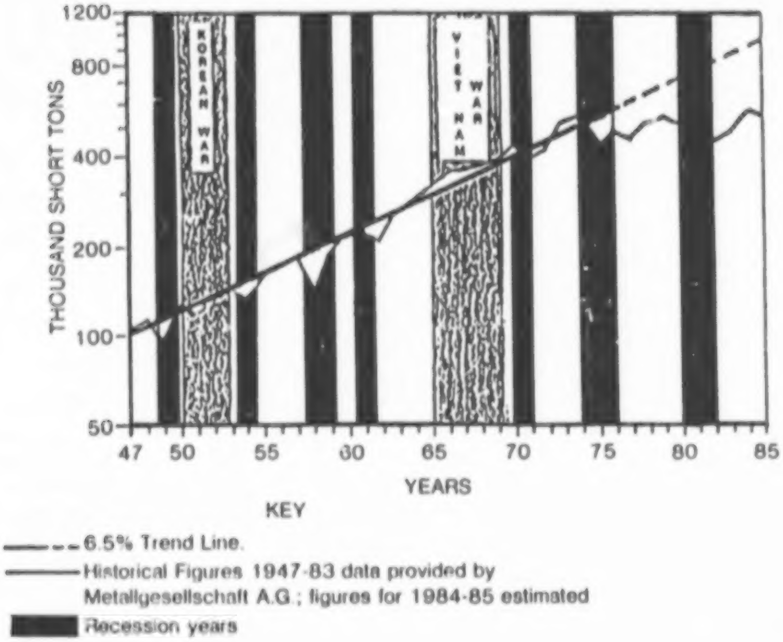
[1] This article was excerpted from a talk given by the author before the Capital Metals Forum, March 27, 1986.

[2] President, Nickel Development Institute, Toronto, Ontario, Canada.

Figure 1 - - NON-SOCIALIST WORLD NICKEL CONSUMPTION

(Courtesy Nickel Development Institute, October 1985)



the losses. Market difficulties have been further aggravated by worldwide reductions in applied research budgets, market development efforts, and promotion programs by nickel producing and consuming industries responding to economic pressures, with the possible exception of Japan.

The Nickel Development Institute

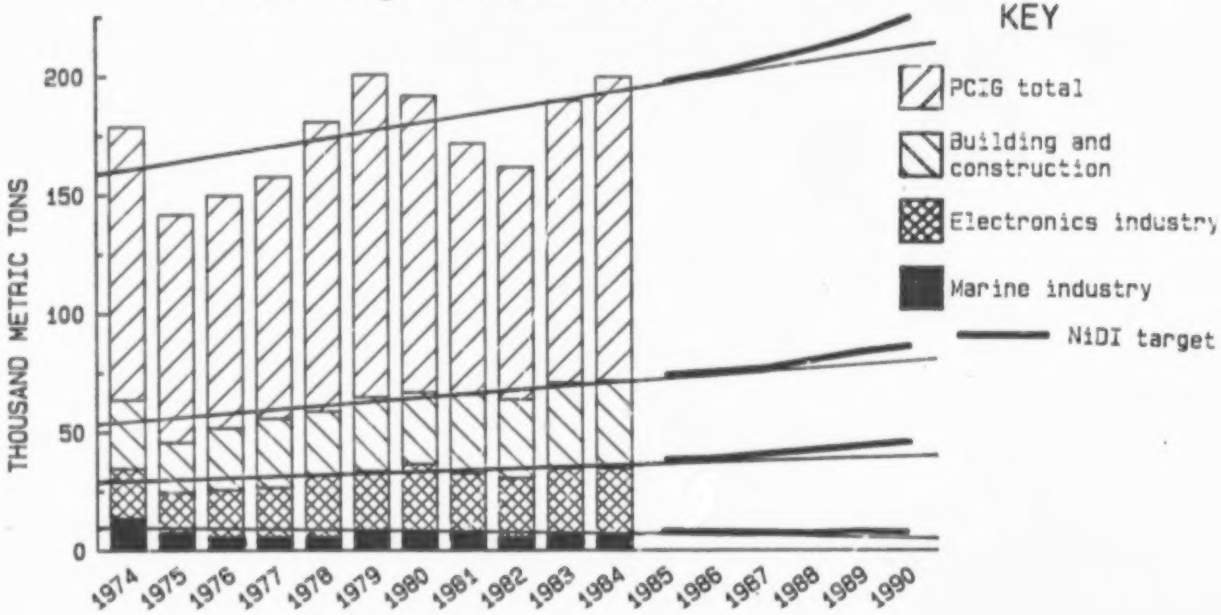
In an effort to reverse the recent fortunes of the nickel industry and more aggressively pursue markets, nickel producers formed the Nickel Development Institute (NiDI) in mid-1984. As of March 1986, 14 producers from 7 countries had joined NiDI. The goal is to have more than 90% of the western world nickel production contributing to the NiDI budget by 1988. The Institute was given an initial budget of $2.1 million for the first full year of operation. In the longer term, expenditures on the order of 1¢/lb of nickel sold will be required to operate an effective and aggressive market promotion program.

NiDI is committed to the following objectives:

- Discovering and developing new uses, as well as improving existing uses, of nickel and nickel-containing products.
- Promoting the use of nickel and nickel-containing alloys in industrialized countries as well as in the developing world.
- Collecting, analyzing, and disseminating technical information on new, improved, and existing uses of nickel and nickel-containing products.
- Serving as a reference center for nickel information and its applications.

The performance of the Institute will be measured in terms of the number of new nickel markets created and substitution losses prevented. NiDI selected the marine industry, which had a negative growth rate over the last 10 years, the electronics industry, the building and construction industry, and the principal capital-intensive group (PCIG) of industries (chemicals, process, power, and petrochemicals) for particular focus (fig. 2).

Figure 2--WESTERN WORLD END USE OF NICKEL:
NiDI Target Industries, 1974 - 90



Source: H.H. Pariser Study, 1985

These industries consume more than 440 million lb/yr of primary nickel, or about one-third of the total western world consumption. NiDI estimates that current market development projects will account for an increase of some 35 million lb/yr by 1990, 58% over the growth expected without such projects.

NiDI Programs

NiDI undertakes three types of projects:

- Market development projects that respond to a clearly identified need and market opportunity where problems can be addressed and solved, and where the threat of substitution can be combated.
- Market exploration projects that respond to a perceived problem or market opportunity for which adequate background information is not available and where investigation is necessary before committing funds to a market development project.
- Research projects in response to technological gaps that are perceived to be impediments to successful market development or that pose a threat to existing markets for nickel-containing materials.

In the long run, some 80% of the funds available for project work will be spent on direct market development and exploration and the remainder on research that supports market development. The industries shown in figure 2 represent markets for which NiDI has implemented market development projects and established demand growth targets. For the other industries, exploration projects will establish whether it is worthwhile to proceed with market development projects.

Recent Accomplishments

Eleven workshops have been completed with engineering companies in the Eastern United States. NiDI consultants discussed material selection opportunities for severe heat and corrosion conditions at the workshops. Similar workshops were held in Toronto and Sudbury and later this year will be conducted in Europe and on the U.S. west coast.

NiDI is working with the American Iron and Steel Institute on the life-cycle costs of materials used in flue gas scrubbers for SO_2 removal. A report on this work, expected later this year, will document the performance of nickel alloys for users of such systems in Europe, Japan, and the United States.

The kitchen sink is the biggest individual application of nickel stainless steel. Its production consumes about 3% of all austenitic stainless steel produced in the world. Both new materials developed by the chemical industry, such as imitation marble, and the old enamelled steel sink are tough competitors because they can be manufactured in a variety of colors. A NiDI study showed that this market is fading faster than had been anticipated by producers. The steel industry and the sink manufacturers are developing a plan to rescue the stainless steel sink from its competitors.

In total, NiDI has implemented about 40 market development and/or exploration projects, some of them supported by research programs that are contracted out in the United States, Europe and Japan.

International cooperation in market development is of utmost importance. Sharing of experience and know-how, exchange of ideas, and pooling of funds are expected to result in early improvements in market shares for nickel. The Institute has concluded formal cooperative agreements with the American Iron and Steel Institute, the Japan Stainless Steel Association, the International Copper Research Association, and the German, Italian, and Spanish Stainless Steel Development Associations.

THE 1985 WORLD ECONOMY, THE 1986 NATIONAL ECONOMY THROUGH MAY, AND PERFORMANCE OF THE U.S. NONFUEL MINERAL INDUSTRY

By Keith L. Harris[1] and Joan Weinberg[2]

World Economy in 1985

Although real output[3] continued to expand worldwide in 1985, it did not reach the 4.4% growth rate achieved in 1984 (table 1). The low growth of output in the industrial countries (2.8%) and sluggish increase in world trade reduced growth for developing countries to 3.2% as their real export earnings stagnated. Output grew more slowly in nearly all the industrial countries. The lagging growth was largely accounted for by a decelerating growth rate in the United States, as the effects of expansionary fiscal policy, investment incentives, and consumer confidence of 1984 began to wane. Japan also experienced slower growth as its export growth fell from 15.5% in 1984 to 4.8%. In 1984, the United States and Japan had experienced the largest increases in output of the major industrial countries (table 2). In the developing countries, output declined 0.1% for the oil exporters, while output of the non-oil-exporting countries rose 4.8%.[4]

Table 1.--WORLD ECONOMIC STATISTICS: WORLD OUTPUT
(Percent change)

	1981	1982	1983	1984	1985
World	1.6	.5	2.6	4.4	2.9
Industrial countries	1.4	.4	2.6	4.7	2.8
Consumer expenditure	.8	1.4	2.9	2.8	2.9
Public consumption	2.3	1.6	1.6	2.9	3.6
Gross fixed investment	-.4	-4.4	2.9	9.0	5.2
Foreign balance	.9	-.2	-.1	-.4	---
Developing countries	2.2	1.6	1.3	4.1	3.2

Source: International Monetary Fund. World Economic Outlook. Apr. 1986, pp. 179, 181, 182.

A bright spot in world economic performance in 1985 was the continuing decline in inflation in the industrial countries, a trend evident since 1980. The weighted average of inflation rates in industrial countries--as measured by the GNP deflator--was 3.9% in 1985, down from 4.3% in 1984. Lower oil prices in 1985 were largely responsible for the drop in the inflation rate, which was also influenced by the pursuit of cautious monetary policies by central banks, moderate wage increases, deregulation in goods markets, and weak raw material prices. The decline in inflation rates in industrial countries contributed to a decline in nominal interest rates in most industrial countries (table 2).

The total volume of world trade continued to decline in 1985. The major cause for the slowdown was the decline in growth of manufactured goods trade, but raw materials trade also slowed.[5] The already large U.S. current account deficit increased further, to 3% of the GNP, at the same time that Japan and the Federal Republic of Germany accumulated current account surpluses. The depreciation of the dollar that began in February 1985 is expected to lead to a modest reduction in the U.S. current account deficit. The

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[1] Physical scientist, Office of Special Projects, Bureau of Mines, Washington, DC.

[2] Economist, Office of Special Projects.

[3] Real gross national product (GNP) or gross domestic product (GDP) for industrial and developing countries and real net material product (NMP) for other countries. See footnote 1 on page 179 of work cited in footnote 4.

[4] International Monetary Fund. World Economic Outlook. Apr. 1986, 268 pp.

[5] Organization for Economic Cooperation and Development. Economic Outlook No. 38. Dec. 1985, 185 pp.

Table 2.—WORLD ECONOMIC STATISTICS

Real GDP and Percent Change from Previous Year
(Billion 1980 dollars; percent change in parentheses)

	1981		1982		1983		1984		1985^{p}	
Canada	270.31	(4.0)	258.56	(-4.4)	265.84	(2.8)	280.25	(5.4)	291.5	(4.0)
France	658.40	(.5)	670.25	(1.8)	675.15	(.7)	684.13	(1.3)	691.0	(1.0)
Germany, Federal Republic of	814.99	(.2)	809.73	(-.6)	819.48	(1.2)	840.55	(2.6)	859.5	(2.3)
Italy	396.21	(.2)	394.15	(-.4)	392.50	(-.4)	402.56	(2.6)	411.6	(2.2)
Japan	1,100.15	(3.9)	1,131.38	(2.8)	1,166.27	(3.1)	1,233.72	(5.8)	1,295.4	(5.0)
United Kingdom	525.78	(-1.4)	533.68	(1.5)	551.72	(3.4)	561.48	(1.8)	579.7	(3.2)
United States	2,695.47	(3.4)	2,615.24	(-3.0)	2,692.15	(2.0)	2,885.02	(6.8)	2,957.1	(2.5)

Interest Rates
(Percent per annum, end of period)

	1981		1982		1983		1984		1985	
	Short term	Long term	Short term	Long term	Short term	Long term	Short term	Long term	Short term	Long term
Canada	14.41	15.27	9.80	11.69	9.71	12.02	9.84	11.66	9.24	10.06
France	NA	17.06	12.71	15.71	12.19	13.99	10.69	11.91	8.95	11.17
Germany, Federal Republic of	10.82	9.7	6.62	7.9	6.48	8.2	5.83	7.0	4.83	6.5
Italy	21.36	21.39	19.11	19.70	16.95	17.69	14.69	14.52	13.10	13.66
Japan	6.74	7.93	6.96	7.50	6.45	6.94	6.33	6.30	7.36	5.82
United Kingdom	14.78	13.89	9.72	10.20	8.84	9.90	9.12	9.99	11.17	9.89
United States	12.97	12.88	7.98	10.33	8.94	11.44	7.75	11.21	7.05	9.60

	Industrial Production Indices (1980 = 100.0, seasonally adjusted)					Standard Unemployment Rates (Percent of total labor force, seasonally adjusted)				
	1981	1982	1983	1984	1985	1981	1982	1983	1984	1985
Canada	100.9	90.1	95.5	103.6	108.0	7.5	10.9	11.8	11.2	10.4
France	99	97	98	100	e/100	7.3	8.1	8.3	9.7	10.1
Germany, Federal Republic of	98.5	95.6	96.3	99.6	105.0	4.4	6.1	8.0	8.5	8.6
Italy	98.4	95.4	92.3	95.4	96.9	8.3	9.0	9.8	10.2	10.5
Japan	101.0	101.4	105.0	116.5	121.7	2.2	2.4	2.6	2.7	2.6
United Kingdom	96.5	98.4	101.9	103.2	108.1	10.6	12.3	12.6	13.0	13.2
United States	102.7	94.9	100.6	112.1	114.6	7.5	9.5	9.5	7.4	7.1

	Consumer Price Indices (1980 = 100.0)					Exchange Rates (National currencies against the U.S. dollar)				
	1981	1982	1983	1984	1985	1981	1982	1983	1984	1985
Canada	112.5	124.6	131.9	137.6	143.1	1.199	1.233	1.232	1.295	1.366
France	113.4	126.8	139.0	149.3	158.0	5.434	6.572	7.621	8.739	8.934
Germany, Federal Republic of	106.3	111.9	115.6	118.4	121.0	2.259	2.427	2.553	2.846	2.944
Italy	118.7	137.3	157.3	174.3	190.3	1,137	1,353	1,519	1,757	1,909
Japan	104.9	107.7	109.7	112.1	114.4	220.6	249.1	237.5	237.6	238.6
United Kingdom	111.9	121.5	127.1	133.4	141.5	.498	.573	.660	.752	.779
United States	110.2	117.1	120.9	126.1	130.5	—	—	—	—	—

e/ Estimate. p/ Preliminary. NA Not available.

Source: Organization for Economic Cooperation and Development. Main Economic Indicators. Apr. 1986, pp. 11, 18, 23, 26, 27, 30, 172.

current account deficit in developing countries was roughly 5% of exports of goods and services, about the same proportion as in 1984.[6]

Since the early 1930's, policy objectives in the industrial countries have stressed reductions in inflation and government budget deficits. Progress has been made in controlling inflation, and some countries have improved their budget position. The large budget deficit in the United States continued to rise in 1985, causing concern over its effect on both current and future interest and exchange rates. The passage of Public Law 99-177 (the Gramm-Rudman-Hollings Balanced Budget Act) in December 1985 indicated a major shift in U.S. policy. (The Supreme Court, however, ruled portions of the law unconstitutional in early July; it remains uncertain as this issue of Minerals and Materials goes to press what the Congressional response to the Supreme Court ruling will be.)

Unemployment rates fell considerably in the United States and Canada in both 1984 and 1985 (table 2). The industrial nations of Europe, however, continued to experience an increase in unemployment throughout the 1980's as a result of slow growth in Europe and increased use of labor-saving equipment.

First-Quarter 1986 Economic Statistics for the United States

According to revised data released by the Department of Commerce, the economy grew at a 2.9% annual rate (after adjustment for inflation) in the first quarter of 1986, 0.3% higher than previously estimated (see Minerals and Materials, February/March 1986, p. 1) and the highest rate since the third quarter of 1985 (table 3). The downward revision was more than accounted for by net exports, which are relatively volatile and difficult to predict, and personal consumption expenditures. Inventory investment and Government purchases were revised upward.

Inventory investment, personal consumption expenditures for nondurable goods and services, residential investment, trade, and State and local government purchases grew compared with those for the previous quarter, while Federal Government purchases and nonresidential investment declined. Inflation, as measured by the fixed-weighted price index for GNP, grew at only a 2.5% annual rate, down from a 3.9% annual rate in the fourth quarter, in part because of significantly lower oil prices.

Second-Quarter Prognosis

The economy is expected to continue to expand during the second quarter. The composite index of leading indicators, designed to predict economic activity over the subsequent 3 to 6 months, rose 1.5% in April, the third consecutive monthly increase. Of the 11 indicators available for April, 7 were positive (money supply, change in credit outstanding, manufacturers' new orders for consumer goods and materials, stock prices, net business formation, average weekly initial claims for State unemployment insurance, and building permits), 3 were negative (average workweek hours, contracts and orders for plant and equipment, and change in sensitive materials prices), and 1 remained unchanged (vendor performance). From the advances and declines of these indicators, economic growth in the second quarter is expected to be derived primarily from continued expansion of consumer purchases and residential construction, while contributions to GNP growth by the manufacturing sector will continue to remain relatively static. The 0.7% decline in the May industrial production index (see below) and the rise in joblessness from 7.0% in April to 7.2% in May support such an observation. While employment rose in the services and construction sectors and resulted in overall increases in total nonagricultural employment during April and May, the manufacturing and mining sectors continued to lose employees (table 4). The manufacturing sector, which lost 39,000 employees in May after losing 8,000 in April, is being hurt by sluggish capital spending and has yet to benefit from the drop in the value of the dollar. Mining sector employment has been hit particularly hard by layoffs caused by the oil price decline, with 31,000 jobs lost in April and an additional 32,000 lost in May.

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[6] Work cited in footnote 4.

Table 3.--NATIONAL ECONOMIC STATISTICS[1]

				1985				[r]1986
Billion current dollars, except as noted	1983	1984	1985	I	II	III	IV	I
Gross national product	3,401.6	3,774.7	3,988.5	3,917.5	3,960.6	4,016.9	4,059.3	4,115.7
Percent change from previous period[2]	7.4	11.0	5.7	6.9	4.5	5.8	4.3	5.7
Fixed-weighted price index for GNP[3]	104.0	108.5	112.4	110.9	111.9	112.7	113.8	114.5
Percent change from previous period[2]	4.0	4.3	3.6	3.5	3.6	2.7	3.9	2.5
Personal consumption expenditures	2,229.3	2,423.0	2,582.3	2,525.0	2,563.3	2,606.1	2,634.8	2,668.2
Durable goods	289.6	331.1	361.5	351.5	356.5	376.0	362.0	363.1
Nondurable goods	817.0	872.4	912.2	895.7	910.2	914.5	928.3	935.6
Services	1,122.7	1,219.6	1,308.6	1,277.8	1,296.6	1,315.6	1,344.6	1,369.5
Gross private domestic investment	501.9	674.0	669.3	657.6	672.8	666.1	680.7	717.2
Fixed investment	508.3	607.0	661.8	639.1	657.3	665.9	685.0	677.3
Change in business inventories	-6.4	67.1	7.5	18.5	15.5	.2	-4.3	39.9
Net exports of goods and services	-5.3	-59.2	-78.5	-42.3	-70.3	-87.8	-113.4	-105.8
Exports	354.1	384.6	369.9	379.6	369.2	363.2	367.8	374.4
Imports	359.4	443.8	448.4	421.9	439.5	451.0	481.2	480.2
Government purchases of goods and services	675.7	736.8	815.4	777.2	794.8	832.5	857.2	836.2
Federal	284.8	312.9	355.4	334.4	337.8	364.8	384.7	357.1
State and local	390.9	423.9	460.0	442.8	457.1	467.7	472.5	479.0
Final sales (GNP less change in business inventories)	3,408.0	3,707.6	3,981.1	3,899.0	3,945.0	4,016.7	4,063.6	4,075.7
Corporate profits[4]	195.0	232.3	224.6	220.6	220.9	233.2	223.7	234.7
Domestic industries	164.2	200.1	192.7	189.4	189.3	203.0	189.1	200.8
Manufacturing	71.3	88.5	76.6	77.3	73.4	79.7	76.1	69.8
Primary metal industries	-2.7	-.9	-.6	-.7	-.9	-.2	-.7	-.2
Fabricated metal products	3.0	5.0	4.2	4.6	4.3	4.6	3.4	5.4
Chemicals and allied products	6.8	8.1	4.9	5.8	5.7	5.6	2.4	4.9
Petroleum and coal products	21.8	18.3	16.5	14.1	11.8	19.7	20.2	8.8
Rest of the world	30.8	32.2	31.9	31.3	31.6	30.3	34.6	33.9
Billion 1982 dollars, except as noted								
Gross national product	3,277.7	3,492.0	3,570.0	3,547.8	3,557.4	3,584.1	3,590.8	3,616.9
Percent change from previous period[2]	3.5	6.5	2.2	3.7	1.1	3.0	.7	2.9
Personal consumption expenditures	2,145.9	2,239.9	2,313.0	2,288.6	2,303.5	2,329.6	2,330.4	2,352.3
Durable goods	283.6	318.6	345.3	335.0	340.3	359.3	346.7	346.1
Nondurable goods	800.7	828.0	846.9	839.9	846.7	849.8	851.1	864.9
Services	1,061.7	1,093.3	1,120.8	1,113.7	1,116.5	1,120.4	1,132.6	1,141.4
Gross private domestic investment	503.4	661.3	649.0	639.6	655.6	645.0	655.7	684.4
Fixed investment	508.9	598.6	643.3	623.8	640.5	646.8	662.0	649.1
Change in business inventories	-5.5	62.7	5.7	15.8	15.1	-1.8	-6.3	35.3
Net exports of goods and services	-19.4	-85.0	-108.4	-71.8	-101.1	-119.8	-140.8	-138.1
Exports	349.3	370.9	359.9	368.7	358.2	353.5	359.2	365.0
Imports	368.8	455.9	468.3	440.5	459.3	473.3	500.0	503.0
Government purchases of goods and services	647.8	675.9	716.4	691.4	699.4	729.2	745.5	718.3
Federal	275.5	292.5	322.6	304.3	305.9	331.1	349.0	319.1
State and local	372.2	383.3	393.8	387.1	393.6	398.1	396.5	399.2
Final sales (GNP less change in business inventories)	3,283.1	3,429.3	3,564.3	3,532.0	3,542.3	3,585.8	3,597.1	3,581.6

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r Revised.

1 Quarterly data are expressed at seasonally adjusted annual rates.

2 Changes are based on unrounded data and so may differ slightly from changes computed from data shown here.

3 1982 weights, 1982 = 100.

4 With inventory valuation adjustment and without capital consumption adjustment.

Source: U.S. Department of Commerce. News. June 18, 1986, tables 1, 2, and 5.

Table 4.—EMPLOYEES ON NONAGRICULTURAL PAYROLLS
(Thousands of workers; seasonally adjusted unless otherwise noted)

	TOTAL NONAGRICULTURAL EMPLOYMENT	MANUFACTURING						MINING				
				Primary metals					Metal mining			
		Total manufacturing	Clay, glass, stone	Total primary metals	Iron and steel	Non-ferrous[1]	Chemicals, chemical products	Total mining	Total metal mining[1]	Iron ore[1]	Copper ore[1]	Non-metallic minerals[1]
1982.....	89,566	18,781	576.9	921.9	396.2	55.5	1,075.1	1,128	72.9	13.2	24.3	109.7
1983.....	90,200	18,434	570.0	831.8	340.8	49.8	1,042.8	952	56.4	10.3	18.9	104.3
1984.....	94,496	19,378	592.6	857.4	334.1	51.4	1,049.4	966	55.1	11.4	16.3	108.5
1985.....	97,614	19,314	590.6	812.8	304.9	45.5	1,045.8	930	46.8	9.8	13.4	110.5
1985:												
Apr...	97,104	19,356	590	821	309	46.9	1,052	949	48.5	10.9	13.8	109.8
May...	97,338	19,323	590	818	308	46.3	1,048	944	48.1	11.0	13.6	114.5
June..	97,442	19,290	589	814	307	45.5	1,046	936	48.0	11.0	13.4	116.4
July..	97,672	19,268	589	807	305	45.0	1,045	928	46.4	9.4	13.3	116.8
Aug...	97,890	19,256	591	798	302	44.1	1,043	922	46.3	10.5	13.2	116.1
Sept..	98,128	19,198	590	795	304	43.9	1,042	917	45.1	9.3	12.8	115.8
Oct...	98,428	19,236	591	797	304	43.7	1,040	913	44.6	9.2	13.0	114.6
Nov...	98,666	19,259	591	801	302	42.4	1,037	907	45.1	9.6	13.1	112.6
Dec...	98,910	19,289	593	803	303	41.8	1,035	901	43.8	8.0	13.5	106.5
1986:												
Jan...	99,296	19,303	596	798	300	42.3	1,034	897	44.6	8.8	13.7	100.3
Feb...	99,429	19,294	597	795	299	41.7	1,032	880	43.9	8.8	12.9	100.4
Mar...	99,484	19,255	594	787	293	41.7	1,031	852	43.9	8.8	13.2	104.2
Apr...	99,797	19,247	600	785	292	41.7	1,028	821	43.7	9.6	12.1	110.5
May...	99,946	19,208	599	779	288	NA	1,025	789	NA	NA	NA	NA

NA Not available.

[1] Not seasonally adjusted.

Source: Bureau of Labor Statistics. Employment and Earnings. Various issues.

Table 5.—SELECTED INDEXES OF INDUSTRIAL PRODUCTION
(Seasonally adjusted, 1977 = 100.0)

	TOTAL INDUSTRIAL PRODUCTION	MANUFACTURING						MINING						
				Primary metals					Metal mining					
		Total manufacturing	Clay, glass, stone	Total primary metals	Iron and steel	Non-ferrous	Chemicals, chemical products	Total mining	Total metal mining	Iron ore	Copper ore	Non-metallic minerals	Coal	Oil and gas
1982.....	103.1	102.2	89.2	65.8	57.5	81.4	103.8	109.3	71.4	66.4	82.6	95.1	119.9	100.1
1983.....	109.2	110.2	99.1	73.0	66.1	86.2	114.0	102.9	65.2	68.8	75.9	106.1	113.3	96.8
1984.....	121.8	123.9	112.3	82.4	73.5	99.3	121.7	110.9	77.0	92.1	78.6	116.1	127.6	99.9
1985.....	124.5	127.1	115.0	80.6	70.6	99.7	127.1	109.0	75.0	87.7	79.4	118.3	127.5	106.3
1985:														
Feb...	123.7	125.8	110.5	80.2	68.5	102.2	125.8	109.5	74.5	73.2	79.3	119.8	121.5	108.2
Mar...	124.0	126.3	111.4	81.8	73.2	98.1	126.5	110.5	83.6	97.0	82.6	118.7	131.9	106.8
Apr...	124.1	126.6	114.5	81.4	71.9	99.3	125.8	109.6	81.2	105.8	74.9	118.5	128.5	106.5
May...	124.1	126.6	116.3	76.4	65.4	97.2	126.7	109.8	78.3	107.1	76.1	118.7	128.7	106.9
June..	124.3	126.7	116.1	78.3	67.6	98.5	126.4	110.6	77.5	97.2	73.8	117.9	134.0	106.9
July..	124.1	126.9	115.1	79.0	68.7	98.5	126.4	108.7	60.9	61.3	92.8	116.6	128.0	106.9
Aug...	125.2	128.2	116.2	82.0	71.6	101.6	128.2	108.3	73.1	106.6	76.0	117.7	127.7	105.5
Sept..	125.1	127.7	116.2	80.3	69.7	100.4	129.0	108.4	71.4	98.4	74.2	119.3	126.3	106.0
Oct...	124.4	127.2	115.6	83.1	74.4	99.5	127.9	108.4	74.2	98.6	77.5	120.4	130.1	104.8
Nov...	125.4	128.4	115.2	83.6	75.3	99.3	128.0	106.9	78.3	90.4	79.5	119.0	125.5	103.5
Dec...	126.4	129.1	118.2	81.7	72.0	99.8	128.5	107.4	74.3	51.7	90.8	114.0	128.0	104.4
1986:														
Jan...	126.7	129.8	120.2	84.9	75.5	102.7	130.5	107.4	75.5	66.1	82.8	117.1	130.6	103.6
Feb...	125.6	128.8	118.8	80.7	69.9	101.2	130.9	105.3	77.2	82.0	77.5	120.2	124.9	101.4
Mar...	124.4	127.8	119.5	77.3	65.0	100.5	130.7	102.7	78.1	80.4	80.7	115.4	123.5	98.5
Apr...	125.0	128.6	120.4	77.9	65.7	100.9	131.2	101.8	76.8	NA	NA	116.1	124.5	97.1
May...	124.2	127.9	NA	77.3	NA	NA	NA	99.6	NA	NA	NA	NA	NA	95.0

NA Not available.

Source: Federal Reserve Board. Statistical Release G.12.3, Industrial Production. June 13, 1986, tables 1A, 2A, and 4A.

Industry Statistics

Industrial production, as measured by the Federal Reserve Board industrial production index, decreased 0.7% in May, more than offsetting the 0.4% gain in April (table 5). The index has declined 2% since the recent peak in January 1986 and is at about the same level as it was 1 year ago. The most significant reduction in output in May occurred in motor vehicles, business equipment, oil and gas well drilling, and durable goods materials. Of the mining sectors shown in table 5, none is operating at levels attained a year ago, although copper ore, nonmetallic minerals, and coal output grew in the latest month for which data are available. Of the mineral material manufacturing sectors, output levels for the clay, glass, and stone, nonferrous metals, and chemical and chemical products sectors are above those attained a year ago, and all but the chemical and chemical products sector grew in the most recent month for which data are available.

Manufacturing industry profits declined $6.3 billion in the first quarter.[7] The decline was more than accounted for by the sagging profits of the petroleum and coal products sector. The primary metal industries as a whole posted a loss of $200 million in the first quarter of 1986. Most steel companies, hurt by continued depressed prices, posted steep first-quarter losses. The United States Steel Corp., now more an energy than a steel producer, managed an $8 million operating profit on steelmaking but reported a loss of $249 million on total operations, reflecting a reduction in the value of the oil inventories of its Marathon Oil unit. Bethlehem Steel Corp. registered a first-quarter loss of $91.8 million, compared with a loss of $62.1 million in the first quarter of 1985, marking the company's 15th loss during the past 17 quarters. (See also items relating to iron and steel in "U.S. Mineral Industry Highlights" of this issue.)

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[7] Seasonally adjusted at an annual rate.

INTERNATIONAL ISSUES AND ACTIONS

CANADA

Agreements Signed With U.S. Bureau of Mines To Foster Cooperation in Mineral Economics and Mining and Mineral Research: On May 29 Canada and the United States signed two memoranda of understanding for the exchange of information in mining and minerals research. The Mineral Policy sector of the Canadian Ministry of Energy, Mines, and Resources signed an agreement with the U.S. Bureau of Mines establishing a U.S.-Canadian working group for the exchange of mineral-related economic and engineering information. The purpose of the agreement is to avoid unnecessary duplication of study programs, increase understanding of mineral-related activities, and increase the analysis capabilities of the two agencies.

The second memorandum of agreement is a 5-year extension of a September 1981 umbrella agreement between the Bureau of Mines and the Canada Centre for Mineral and Energy Technology (CANMET). The renewal will permit the continuation of cooperative research and development efforts in mining and mineral processing technology. Among the current projects under this program is the development of a ceramic exhaust filter for removing soot from the exhaust of diesel-powered machines. About 3,000 such machines are in use in underground mines in Canada; in the United States, about 6,500 such machines are in use in underground nonfuel mineral mines, and about 1,000 are in use in underground coal mines.

Court Rules Against Lac Minerals in Multi-Billion-Dollar Lawsuit Over Hemlo Gold Deposit: The Ontario Supreme Court has ruled that Lac Minerals Ltd. must hand over to International Corona Resources the disputed Page-William Mine working the Hemlo gold deposit near Marathon, Ontario. This decision, in the largest lawsuit in Canadian history, could make International Corona Resources the second largest gold producer in Canada.

Litigation over the Hemlo gold deposit, the largest and most publicized mineral development in Canada in recent years, stemmed from Corona's allegation that Lac Minerals' acquisition of the Page-William Mine in July 1981 was improper because Lac had obtained confidential information from Corona geologists while the two companies were negotiating a joint venture.

At current gold prices, the value of the estimated reserves of 9 million tr oz at the Page-William Mine could be as high as $2.5 billion after deducting production costs. Corona must reimburse Lac for $154 million of the $204 million spent bringing the mine into production. Lac Minerals has appealed the decision.

CHINA

China Plans Major Increases in Production and Export of Industrial Minerals: The Chinese Government plans to double its investment in the exploration and development of nonmetallic minerals during its seventh 5-year plan (1986-90). About $170 million will be spent in an effort to double the value of nonmetallic minerals exported to $400 million by 1990. Twelve mines will be developed for the export market, including three each for talc and graphite and two or three quarries for granite and marble. By 1990, annual production of asbestos is projected to reach 200,000 mt, annual production of graphite is projected to reach 250,000 mt, and annual production of talc is projected to reach 1.7 million mt. U.S. imports from China of asbestos, graphite, talc, and dimension stone were valued at $6.2 million in 1985.

China Adopts New Mineral Resource Law: A law to address mineral resource issues was adopted on March 19, 1986, for inclusion in the Constitution of the People's Republic of China. The new law, effective October 1, 1986, delineates ownership, mining rights, and licensing for mineral exploration and development.

U.S.S.R.

Soviets Proceed With Seabed Exploration: The research ship Yuzhmorgeologiya (South Seas Geology) was sent on a test cruise in the

Mediterranean Sea in March 1986 to explore for ferromanganese nodules. The U.S.S.R. is a signatory to the United Nations Law of the Sea Convention and has applied for mining rights to a 300,000-km^2 section of Indian Ocean seabed under the terms of the convention. Soviet experiments with smelting nodules from the Indian Ocean floor reportedly indicate they are excellent sources of manganese, nickel, cobalt, and copper.

Since the early 1970's, the U.S.S.R., Czechoslovakia, the German Democratic Republic, Hungary, and Poland have conducted 7 exploration surveys in the central Atlantic and 10 surveys in the Pacific, acquiring data on the location and character of ferromanganese nodules. These countries also have engaged in offshore exploration for titanium and zirconium ores and maintain an ongoing exploration and development program for offshore hydrocarbons.

Soviets Request Potassium Iodide as Thyroid Blocking Agent After Chernobyl Accident: The Soviet Embassy in the United States is attempting to arrange for the purchase of 100 mt of potassium iodide (KI) from U.S. producers in the aftermath of the April 26 accident at the Chernobyl nuclear power plant, which released the radioactive isotope iodine-131 into the atmosphere. Although iodine-131 has a half-life of only about 8 days, some contamination from radioactive iodine in the environment and in food produced may remain a problem for the U.S.S.R. The administration of KI blocks the uptake of radioactive iodine by the human thyroid gland. Administered before exposure to iodine-131, KI can block up to 90% of potential thyroid uptake; administered 4 hours after exposure, it can block about 50% of the uptake. The Japanese estimate that the thyroid blocking use will cause an additional 1- to 2-million-lb demand in 1986.

BISMUTH

Japanese Firm Uses Bismuth To Develop New Free-Cutting Stainless Steel Grade: Daido Steel Co., Ltd. (Japan) recently announced the development of a new grade of free-cutting stainless steel achieved by adding bismuth. Stainless steels are difficult to machine, and the free-cutting properties desired with machining steel typically have been achieved through the addition of lead and sulfur. The Japanese development using bismuth follows the introduction of a free-cutting, bismuth-added carbon steel grade by Inland Steel Co. 5 years ago. Wide acceptance of bismuth-containing free-cutting steels in the marketplace could cause world demand for bismuth to rise significantly.

COPPER

Codelco To Join International Copper Research Association: In a change of policy, Corporacion National del Cobre de Chile (Codelco) has applied for membership in the International Copper Research Association Inc. (INCRA). Codelco also plans to invest $500,000/yr in its own marketing campaign in Europe. Although Codelco's annual contribution to INCRA will be less than $150,000, its membership is expected to strengthen INCRA's efforts to develop new markets for copper.

GOLD

Japan To Issue Commemorative Gold Coin: The Government of Japan, which plans to commemorate the 60th anniversary of the reign of Emperor Hirohito with the minting of 10 million gold coins, was considering the purchase of 6.4 million tr oz (200 mt) of gold bullion on overseas gold markets by June 1986. Purchases of gold on the New York, London, and Zurich markets would be in small lots to avoid distortion in the world's markets. Japanese imports of gold, including semimanufactured forms and scrap but excluding coins, reportedly hit a record high of 1.9 million tr oz in April. These imports do not include gold destined for use in the commemorative coin program.

IRON AND STEEL

Voest-Alpine Announces $537 Million Loss for 1985: Voest-Alpine, the Austrian state-owned steel and engineering company, suffered unprecedented high losses in 1985, causing the resignation of its chairman and the entire management board. Voest is Austria's largest industrial firm, with 70,000 employees and broad international interests, including steel and other interests in the United States. Voest's $537 million loss in 1985 is attributed mainly to unsuccessful diversification, speculation in the oil market, and new areas of activity taken on to compensate for the decline of the steel industry. In addition, Voest has suffered operating losses and investment costs of about $290 million from Bayou Steel, Inc., its U.S. minimill subsidiary in Mississippi, since Bayou's establishment in the late 1970's.

NICKEL

Falling Oil Prices Benefiting Nickel Producers: As a result of the recent decline in crude oil prices, operating costs of producing nickel from laterite ores have dropped 30¢ to 80¢/lb. The oil price decline provides welcome relief to major nickel producers, particularly those around the Pacific Ocean Basin, since many had been losing money on nickel sales at the recent prices of around $1.90/lb. Nonetheless, the industry has expressed concern that a return to profitability will stimulate production from marginal producers, resulting in further erosion of nickel prices.

Final Preparations for Establishment of International Nickel Discussion Group: Representatives from major nickel producing and consuming nations met in Geneva, Switzerland, April 14-18, 1986, for the final preparatory meeting prior to establishing an International Nickel Discussion Group (INDG) (see Minerals and Materials, October/November 1985, p. 5). The organization will become official when at least 15 countries representing 50% or more of the world trade in nickel accept the charter "terms of reference." The terms of reference have been provided to the Secretary General of the United Nations, who forwarded copies to the participating governments for response by September 20, 1986. The inaugural meeting of the INDG could take place by the end of October if this schedule is met.

The United States did not participate in the meeting because of skepticism that Soviet-bloc countries would supply the INDG with nickel production data. This perception may change since Cuba has announced it would provide data to the group, and the Soviets reportedly are reconsidering earlier decisions to withhold data from groups such as the International Lead Zinc Study Group.

TIN

International Tin Council Ends All Export and Production Controls: The International Tin Council has agreed to end all export and production controls for its 22 member nations, thereby permitting producer countries to dispose of an estimated 40,000 mt of tin concentrates now held at mineheads. The controls have been in effect since 1982 as a device to alleviate excess world tin supply. The end of controls is expected to further depress already low tin prices. The sharp drop in tin prices over the past 6 months already has caused mines to close in Australia, Bolivia, Malaysia, Thailand, and the United Kingdom.

FEDERAL, STATE, AND LOCAL ACTIONS

ENVIRONMENTAL ISSUES

EPA Denies Exemption to West Virginia Power Plant: The U.S. Environmental Protection Agency (EPA) denied a request to exempt the Kammer Power Plant of American Electric Power Co. (Marshall County, WV) from new air pollution regulations. All but 5% of Kammer's output goes to the Nation's second largest operating aluminum smelter, owned by Ormet Corp. (Hannibal, OH). American Electric, Ormet, and Consolidation Coal Co. (Consol), whose Ireland Mine is Kammer's primary supplier of fuel, had asked the EPA last September to exempt the Kammer plant from the regulations, which went into effect last July. Kammer had installed tall stacks to meet air quality standards under old EPA regulations. The July 1985 amendments require scrubbers at Kammer or the burning of low-sulfur coal, which is not mined in the area. American Electric claims it now cannot afford to be in compliance at Kammer. Since Consol's mine provides coal to Kammer, Kammer powers Ormet, and Ormet's aluminum provides the feedstock for the neighboring Consolidated

Aluminum Corp. rolling mill, the EPA ruling could have wide-ranging economic impacts on the region.

Negotiations Continue Over Emission Controls at Phelps Dodge's Douglas Copper Smelter: Phelps Dodge Corp. continues to negotiate with the EPA over a consent agreement that would allow the company's Douglas, AZ, copper smelter to continue operating until the end of 1987. EPA held a public hearing on May 17 at Cochise College (near Douglas), at which Phelps Dodge officials, Douglas community leaders, critics of the smelter, and the Governor of Arizona discussed a proposal by Phelps Dodge for a 90-day suspension of final sulfur dioxide standards to allow the company to negotiate the issue.

Phelps Dodge Corp. previously offered to close its 82-year-old smelter at Douglas at yearend 1987 in exchange for permission to operate at current emission levels until that time, but EPA denied the request. An agreement between the Mexican and U.S. Governments to limit pollution in the "Gray Triangle" of Nacozari and Cananea (Mexico) and Douglas, AZ, calls for the strict enforcement of emission limits at copper smelters in the three areas by January 1988. The EPA believes that Phelps Dodge eventually will be able to satisfy the technical requirements and that a consent decree could be devised to satisfy the obligations of the U.S.-Mexican agreement. Under the Clean Air Act, all domestic copper smelters must meet Federal pollution standards by January 1988. Only the Douglas smelter and Magma Copper Co.'s San Manuel smelter remain out of compliance; other smelters either have met the requirements or have shut down.

LAND USE

Supreme Court To Hear Arguments on Applicability of State Permiting Requirements to Mining Operations on Federal Lands: The Supreme Court will decide whether individual States may require companies to obtain State permits for mining operations on Federal lands in addition to Federal approval. The Justices will hear arguments by the California Coastal Commission, which seeks to protect from mining development the scenic Big Sur coastal area including and/or adjacent to portions of the Los Padres National Forest. The ruling in the case, not expected until 1987, may affect environmental regulations in many States, particularly in the West. The case involves the Granite Rock Co., which began mining on National Forest Land in 1981. The 9th U.S. Circuit Court of Appeals ruled previously that the State permit requirement is preempted by Federal regulation.

FOOD AND DRUG ADMINISTRATION

FDA Guidelines Recommend 80% Reduction of Iodine in Animal Feeds: Effective September 1, the recommended amount of iodine consumed per day in animal feeds was lowered from 50 to 10 mg per head, according to a new Food and Drug Administration (FDA) Compliance Policy Guideline. The decision was based on two National Academy of Sciences-National Research Council studies on the nutrient requirements of beef cattle. The new guideline is expected to reduce consumption of iodine in animal feeds by about 80% the first year. Consumption of iodine in animal feeds was about 1.6 million lb, or about 25% of reported domestic consumption, during 1985. Iodine is one of 14 mineral commodities listed by the National Feed Ingredients Association as used for domestic meat production.

TRADE ISSUES

ITC To Consider Countervailing Duty Petitions Against Brazilian and French Brass Producers: The International Trade Commission (ITC) voted unanimously in late April to accept countervailing duty petitions against Brazilian and French brass producers and to consider antidumping petitions against brass suppliers in Brazil, Canada, the Federal Republic of Germany, France, Italy, the Republic of Korea, and Sweden. A coalition of U.S. brass mill operators, copper fabricators, and unions filed the petitions in March. The ITC will estimate the injury to U.S. industries, and the International Trade Administration will consider dumping margins and penalty duties. Preliminary findings were expected within 5 months.

FEDERALLY FUNDED RESEARCH

Minnesota Seeks Energy Department Funding for Demonstration Iron Ore Plant: In mid-April the Minnesota State Department of Natural Resources, United States Steel Corp., and Korf Engineering GmbH. submitted a joint proposal to the Department of Energy requesting $50 million for part of the cost of constructing a commercial-size plant using the Kohl reduction (KR) process to produce iron at Mountain Iron, MN. If approved, the money would come from the $400 million fund established under the clean coal portion of Public Law 99-190, a Federal appropriations bill. The 363,000-st/yr furnace would be constructed next to U.S. Steel's Minntac pellet plant and would cost more than $100 million. U.S. Steel and the State of Minnesota would provide the additional $50 million.

The KR process uses coal instead of coke to reduce lump iron ore, sinter, pellets, and other ferruginous materials. It also produces a gas that can be used for heating, to produce oxygen, or to generate electrical energy. Korf Engineering, a unit of the Austrian Voest-Alpine Group, already has a 60,000-st/yr demonstration KR plant at Kehl, Federal Republic of Germany, and has just begun constructing a commercial-size plant at the steel complex of South African Iron & Steel Industrial Corp. Ltd. (ISCOR) near Pretoria in the Transvaal.

STATE AND LOCAL ACTIONS

Utah Approves Plan To Pump Flood Waters from Great Salt Lake: On May 14 the Utah legislature approved a $55 million plan to pump record flood waters from Great Salt Lake into the desert valley west of the lake. The lake has risen to a record 4,211.65 ft above sea level and has doubled its volume in the past 4 years to 30 million acre-ft. The pumping project, expected to take 6 months to 1 year for construction, should lower the lake 13 to 16 in the first year and 7 to 8 in/yr thereafter.

On June 7, high winds and the high level of the lake caused a 1-mile breach in the dikes at the solar evaporation ponds of AMAX Magnesium Corp. (the second largest producer of magnesium in the United States); the ponds could be out of service for 3 years. High water levels in 1984 flooded the solar evaporating ponds of Great Salt Lake Minerals and Chemicals Corp., an important producer of potassium sulfate, salt, and magnesium chloride from the lake brines. Other companies threatened by the rising lake are American Salt Co. and Western Zirconium Inc.

New Mexican Mining Companies Support Job Replacement Effort: Mining companies in Cibola County, NM, have contributed to a new foundation that hopes to attract new businesses to the area. Cibola County has lost about 7,000 mining jobs since 1980, leaving it with fewer than 4,000 paid nonagricultural jobs. The new foundation, called the Cibola Foundation, has received financial support from SF Coal Corp., Phillips Uranium Corp., Homestake Mining Co., and UNC Corp., which will go to the foundation's work of making equity investments and buying down interest rates on loans for industrial expansion or relocation.

U.S. MINERAL INDUSTRY HIGHLIGHTS

COBALT

Cobalt Price Decline Continues: Prices continued to decline in the United States, reaching a 1986 low of about $8.50/lb of electrolytic cobalt in mid-May. According to industry sources, Zaire is discounting its cobalt in an effort to regain its share of the U.S. market lost in recent months to other producers such as Zambia and Canada.

COPPER

Arizona Copper Industry Continues To Seek Labor Concessions: Arizona copper producers continue to seek wage and benefit concessions on labor contracts due to expire in mid-1986. In early April, Inspiration Consolidated Copper Co. proposed an overall 27% reduction in wages and benefits affecting 625 of a total of 900 workers at the company's

Miami operations. Inspiration has asked the union for a settlement without a labor disruption. The company has been experiencing rising costs, including quarterly cost-of-living adjustments, environmental and other regulatory costs, and losses totaling $145 million since 1979.

Workers at Newmont Mining Corp.'s Magma Copper Co. and Pinto Valley Copper Corp. rejected wage offers proposed by Newmont that would result in a 30% reduction in labor costs. A formal contract offer made earlier this year sought an average $5/h concession from its workers that would have saved Newmont $30 million to $35 million per year. Currently, wages and benefits average just under $20/h. Of the 3,850 workers employed by Newmont at its two Arizona operations, about 3,000 are represented by unions.

Pennzoil Donates Relief Funding for Unemployed Copper Workers: In April, Pennzoil Corp. donated $60,000 to Pima County, AZ, to help finance "transition and placement counseling" for workers not rehired by Cyprus Minerals Co. When the Sierrita Mine was purchased by Cyprus Mines Corp., parent company of Cyprus Minerals, the operation was closed and 1,100 workers were laid off, 630 of whom were to be rehired. A severance package provides laid-off employees with 70% of weekly pay for 4 to 6 weeks. Pennzoil is the parent company of Duval Corp., former owner of the Sierrita Mine, south of Tucson, AZ.

IRON AND STEEL

Major Producers Continue Sale of Steel Holdings: United States Steel Corp. (USS), the largest U.S. producer of steel, continued to sell off a number of steelmaking assets, including a rod mill (Joliet, IL), a rod, wire, and strip plant (Cuyahoga Heights, OH), and a specialized wire plant (Cleveland, OH), all of which were sold to American Steel & Wire Corp. In addition, USS recently sold most of its agrichemical division and has announced plans to reduce its administrative employment by 15%, or 1,800 employees, by yearend 1986. USS reported a loss in the first quarter of 1986, its first loss since the fourth quarter of 1983. The $249 million loss reflected declining oil prices, which fell to $9.74/barrel, the lowest price in more than 8 years. U.S. Steel purchased Marathon Oil Co. in 1982 for $5.8 billion and Texas Oil & Gas this year for $3.7 billion, reducing steelmaking activities to 31% of the company's total business. The effect of the decline in oil prices on the company could affect its negotiations with the United Steelworkers Union, whose contract expires July 31.

Bethlehem Steel Corp., the third largest U.S. producer, continues to try to raise cash by selling off steel-related assets, including the J.M. Tull Industries steel service center chain it bought only a year ago, its reinforcing bar fabricating division, a steel tank fabricator, and ore ships. Bethlehem also has sought to sell a number of its other holdings, including the Bethlehem limestone quarries and reserves, Kusan, Inc. (a plastic and building supply subsidiary), and various parcels of real estate.

National Steel Reaches Preliminary Labor Agreement With USW: National Steel Corp. reached a new contract agreement with the United Steelworkers of America (USW) effective April 28, 1986. The National Steel agreement is estimated to reduce hourly employment costs 6%. The 39-month contract guarantees no layoffs of union members in exchange for company flexibility in setting work rules. Through attrition, the company expects to reduce total employment from 12,500 to 9,000 over the life of the contract. LTV Corp. reached a similar agreement with the USW effective April 1, 1986.

Chicago-Area Steel Mills Lay Off Over 2,500 Workers in First Quarter 1986: Steel mills in northwest Indiana and neighboring Chicago, IL, dropped more than 2,500 workers from their payrolls in the first quarter of 1986. Employment at these plants fell from 39,900 at the beginning of 1986 to 37,400 at the end of the first quarter. Employment fell 42% at the Chicago plant of LTV Steel Co., where over 1,300 workers were laid off, and 133 workers lost their jobs at LTV's Indiana Harbor Works in East Chicago. Inland Steel Co., East Chicago, reduced its staff by 770 and expects to make further cutbacks when it closes its last open hearth steelmaking operation later this year. Bethlehem Steel Corp. (Burns Harbor, IN) and U.S. Steel Corp.

(Gary, IN) reported decreases of 200 and 100 employees, respectively.

Four Companies Announce Cooperative Development Project: Armco Inc. (Middletown, OH), Bethlehem Steel Corp. (Bethlehem, PA), Inland Steel Co. (Chicago, IL), and Weirton Steel Corp. (Weirton, WV) entered into a cooperative agreement in April to develop a new direct sheet casting process. The new process, under development by Bethlehem Steel since 1981, involves casting sheet steel directly for use by cold-mill finishing facilities, bypassing the conventional hot-mill process. The energy-saving process is expected to be available commercially within 10 years and will provide steel for the appliance, automotive, construction, and container industries.

Proposed Employee Buyout of Steel Plant Enters Second Phase: The USW has entered into the second phase of a proposed employee buyout of Wheeling-Pittsburgh Steel Corp.'s idled Benwood, WV, tube mill. The union will look at forming a management team, then concentrate on investigating possible funding sources. The first phase of the of the buyout was a feasibility study, funded two-thirds by the West Virginia Governor's Office of Economic and Community Development and one-third by the USW international office.

About 200 workers have been laid off from the Marshall County facility for about 2 years. Wheeling-Pittsburgh, in the midst of trying to reorganize in Federal bankruptcy court, says it has no plans to reactivate the plant. (See Minerals and Materials, December 1985 /January 1986, p. 14.)

IRON ORE

North American Iron Ore Industry Undergoes Restructuring: The iron ore industry of the United States and Canada underwent a major restructuring in May aimed at lowering pellet costs and improving the financial health of the industry. After exchanging equity interests with LTV Steel Co., Bethlehem Steel Corp. became the largest shareholder in Iron Ore Co. of Canada (IOC), Canada's largest iron ore producer. The exchange increased Bethlehem's interest in IOC from slightly over 20% to nearly 33%. Other iron and steel companies with interests in IOC retained their previous shareholdings but modified their existing pellet contracts by extending the terms and amending volume and price provisions. Bethlehem Steel and Stelco Inc. split LTV's 16% interest in Hibbing Taconite Co. (Minnesota), raising Bethlehem's share in that company to 70.3% and Stelco's share to 14.7%. At the same time, LTV became full owner of the Erie Mining Co. (Hoyt Lakes, MN), previously a joint venture among Bethlehem, LTV, Stelco, and Interlake, Inc.

PHOSPHATE ROCK

Four Producers Announce Withdrawal From Phoschem: The Phosphate Chemical Export Association (Phoschem), a cartel representing 90% to 95% of the export tonnage of fertilizer from the United States, received notification in May 1986 from four companies of their intent to leave the association within 90 days. The resigning companies--Royster Co., USS-Agrichemicals, Conserve, Inc., and Agrico Chemical Co.--apparently are unhappy with Phoschem's designated allocations and sales policies. The defections represent a serious challenge to the future existence of Phoschem and could have a major impact on the U.S. phosphate industry by reducing export sales of processed phosphates and by increasing competition, contributing to pressures to lower prices.

SELECTED NEW CONTRACTS, INVESTMENTS, EXPANSIONS, AND EXPLORATION ACTIVITIES: UNITED STATES

Commodity and Company	Operation and/or Location	Notes
ALUMINUM		
Advanced Aluminum Products Inc.	Hammond, IN, and other locations.	Began production at its new minimill and announced plans to build 2 more aluminum minimills. Company owners hope to duplicate the success that the steel industry has had with this type of operation. Minimills typically obtain 90% of their raw material from scrap and produce a narrow product line. The company's new mills will have a capacity of 100 million lb/yr each and will produce coiled sheet for the building products industry. Construction is expected to begin this year on 1 mill in the Southeast, and the 2d mill, to be built in the Southwest, should be in production in late 1988.
Commonwealth Aluminum Corp.	Lewisport, KY.	Announced that it will invest $20 million to modernize the hot line at its 450-million-lb/yr rolling mill, converting the operation to full computer control. The mill primarily produces non-heat-treated sheet, plate and coil, and some rigid container stock. The project, expected to begin in May 1986, is scheduled to be completed in the fourth quarter of 1987.
Ohio River Associates.	Hannibal, OH, and Burnside, LA.	Agreed to buy Ormet Corp. from Consolidated Aluminum Corp. and Revere Copper and Brass Inc. Both companies had been seeking to sell their interests in Ormet in order to stem losses resulting from high production costs. Ormet operates a primary aluminum smelter in Hannibal, OH, and an alumina plant in Burnside, LA. The smelter has been operating at 100% of its 27,000-st/yr capacity; production at the alumina plant was halted in December.
CEMENT		
Southwestern Sunbelt Cement.	Headquarters, Phoenix, AZ.	Southwestern Portland Cement Co. of Los Angeles, CA, has formed a joint venture with the Mexican firm, Cementos Mexicanos, the largest cement producer in Latin America, to market both Mexican and U.S. cement in the United States. The new company, owned equally by the two firms, will serve markets in San Diego, CA, Phoenix, AZ, Albuquerque, NM, and El Paso, TX.
Independent Cement Co.	Catskill, NY.	Announced plans to open up major new quarries in Catskill. The company plans to mine 590 acres of a 1,500-acre mining tract. The remainder would be used for stockpiling, a new aggregate processing plant, and administrative buildings. The company is drawing up a draft environmental statement.
CERAMICS		
Aluminum Company of America (Alcoa).	Latrobe, PA.	Purchased a majority interest of Pakco Industrial Ceramics Co. Alcoa plans to use its advanced ceramics technology developed over the past 2 yr at a cost of $20 million to produce high-performance ceramics such as titanium diboride and silicon carbide.
CLAY		
Engelhard Corp.	Seneca, SC.	Began construction of a plant to produce custom catalysts for manufacturers of industrial, consumer, and pharmaceutical products. The $25 million facility is expected to employ 200 people.
Glen-Gery Corp.	Reading, PA.	Mining resumed after a 4-yr zoning dispute was settled. Glen-Gery agreed to restore mined land to its original condition, protect the ground water, and pay $10,000 to Lower Heidelberg Township. The Township agreed to enlarge the area Glen-Gery is allowed to mine.
COPPER		
Copper Range Co.	White Pine Mine, White Pine, MI.	Started reheating the No. 2 reverberatory furnace, which had been shut down since 1982. The company plans to begin smelting concentrates from the mine, which is producing ore at the rate of 8 million lb/month recoverable copper.
Magma Copper Co.	San Manuel, AZ.	Announced plans to start its new $70 million project by midsummer. The project includes a 22,000-mt solvent extraction electrowinning plant and associated 83-acre plastic-lined leach pad and drainage system. The plant incorporates new technology including stainless steel starter sheets and a patented gasket system for minimizing acid fuming.
Noranda Lakeshore.	Noranda Lakeshore Mine, AZ.	Announced plans to begin production by midsummer from experimental in situ leaching of oxidized copper ore from the deeper ore body. If successful, the new technique would give the mine a lifespan of 30 yr at current costs of less than 50¢/lb copper.

COPPER AND ZINC

Exxon Minerals Co.	Crandon, WI.	The Wisconsin Department of Natural Resources has released a Draft Environmental Impact Statement on the proposed Exxon Crandon Project. Public comments on the project will be accepted until July 7, 1986, and will be considered in the Final Environmental Impact Statement to be prepared shortly thereafter. Mine permit hearings are expected to be held late in 1986.

GOLD

Amselco Minerals Ltd. and Galactic Resources Ltd.	Columbia, SC.	Announced a joint agreement to develop a gold property containing 51 million st of ore with a grade of 0.039 tr oz/st gold. The mine could be operational by late 1987 or early 1988, and production is expected to average 160,000 tr oz/yr gold.
FMC Corp.	Paradise Peak gold mine, Nye County, NV.	Began mining and milling in April; 1st gold and silver was poured during week of Apr. 24. The new open pit mine and 4,000-mt/d mill have been under development for 3 yr. The 1.2-million-mt deposit, ranked as the 7th largest gold reserve in the Nation, contains about 1.1 million tr oz recoverable gold and 30 million tr oz recoverable silver. Company expects to produce 100,000 tr oz/yr gold and 3.5 million tr oz/yr silver.
Galactic Resources Ltd.	Summitville Mine, CO.	Began production Apr. 16. Galactic invested about $31 million in developing the open pit, heap-leaching operation and projected production at about 120,000 tr oz/yr gold from approximately 5.3 million st of material processed, which would make it Colorado's largest and one of the Nation's major gold producers. About 25,500 tr oz gold was reported produced in Colorado in 1985, and 60,000 tr oz in 1984.
Hecla Mining Co.	Knob Hill Mine, Republic, WA.	Announced it is sinking a new ventilation and service shaft. Work began in mid-April on the $2.1 million, circular, steel-lined shaft. The new shaft will be about 1 mile south of the existing shaft and is expected to be in service by December. Current mine production rate is 60,000 st/yr at an average mining cost of $160/st. The mine produced 39,132 tr oz gold and 101,521 tr oz silver in 1985.
Sunnyside Gold Corp.	Sunnyside gold mine, Silverton, CO.	Resumed gold and silver mining operations following closure in March 1985. Mine was purchased by Echo Bay Inc. from Standard Metals Corp. in September 1985.
Tenneco Mineral Co.	McCoy gold mine, Lander County, NV.	Began production in May at new mine near Battle Mountain. Full production of 75,000 tr oz/yr is expected to be reached in 1987.
Western Goldfields Co. and Ferret Exploration Co.	Washoe County, NV.	Began construction of facilities at the Hog Ranch property. Initial production at the open pit is scheduled for the fall of 1986. Full production is expected to reach 1 million st/yr in 1987, with an estimated yield of 50,000 to 60,000 tr oz/yr gold. Gold extraction will be by conventional heap leach with carbon recovery.

IRON AND STEEL

American Banaco Inc.	Various locations.	Bethlehem Steel Corp. has signed an agreement to sell its fabricated reinforced bar division to American Banaco Inc. (New York) for an undisclosed price. Bethlehem, which has posted losses in 14 of the past 16 quarters, is selling assets to raise capital. This sale involves 14 facilities in 12 States and about 500 employees.
Bethlehem Steel Corp.	Burns Harbor, IN.	Began production of steel slabs through its new No. 2 continuous caster. When both of the plant's casters are in full operation, the company will be able to cast about 75% of the plant's raw steel production.
Broken Hill Pty Co. Ltd. (BHP).	City of Commerce, CA.	Australia's largest company and principal steel producer recently acquired an 80% interest in Brumley-Donaldson Co. of California, the trading company that handles 80% (90,000 to 100,000 mt/yr) of the Australian steel exported to the United States. The company will be renamed BHP Trading Inc. BHP's interest in Brumley-Donaldson was acquired from Tubemakers of Australia Ltd., the Australian pipe and tube producer, which is 50% owned by BHP.
Double Eagle Steel Coating Co. (joint venture of United States Steel Corp. and Rouge Steel Co.).	Dearborn, MI.	Began production from its new 700,000-st/yr electrogalvanizing line.
Enduro Stainless Inc.	Masillon, OH.	Reached an agreement in principle to sell the idle Enduro steel mill. The mill, sold to private investors in late 1984 as part of an agreement with the U.S. Justice Department, was closed in November 1985. Enduro subsequently filed for creditor protection under Chapter 11 of the U.S. Bankruptcy Code on February 21. The sale was made to avoid antitrust law violations in the merger of J&L Steel Corp. and Republic Steel Corp. in June 1984. Enduro had been a part of Republic Steel.

LS Electrogalvanizing Co. (joint venture of LTV Steel Co. and Sumitomo Metal Industries, Ltd., of Japan).	Cleveland, OH.	Began commercial operation of its new sheet steel electrogalvanizing line using Japanese technology and equipment.
McLouth Steel Products, Corp.	Trenton and Gibraltar, MI.	Union workers ratified a new contract agreement that allows for the early retirement of 250 workers and a freeze of cost-of-living allowances in return for wage increases, a company-paid dental insurance plan, and higher pay for some jobs. The agreement, which runs through mid-November 1988, paves the way for private investors to pay in $15 million to help the company alleviate cash flow problems.
North Star Steel Corp.	Youngstown, OH.	Announced plans to modernize the pipe mill at its Youngstown facility, with startup scheduled for early 1987. North Star plans to capture a increasing share of that part of the market for tubular goods used by the oil industry that is now being supplied by foreign producers and to penetrate other markets that require high-quality, seamless tubing.
Nucor Corp.	Plymouth, UT.	Announced a $30 million expansion of its steel rolling minimill. Plans are to double capacity and allow specialization of the new equipment in smaller merchant bars and shapes. The existing mill would be freed up for larger sizes. Expected to be in operation by August 1987, the expansion would create about 100 jobs.
"	Not available.	Signed a letter of intent with Yamato Kogyo Co., a Japanese electric-furnace steelmaker, for joint building of a 600,000-st/yr minimill in the United States. Yamato Kogyo brings experience in producing medium- and large-size beams to the joint venture. Nucor is eager to expand its product lines to include beams and flat-rolled products because new producers have flooded the market for traditional minimill products. The company expects to build the new mill for about $200 million, and start operation in mid-1988.
Pellet Technology.	Eagle Mills, MI.	Plans to open an 80,000-st/yr plant in July to demonstrate a variety of new steel technologies, including the recycling process. The State of Michigan gave the company a $5.7 million unrestricted grant to establish the demonstration unit at a research center in Eagle Mills, which was donated by Cleveland Cliffs Iron Co.
Steel Technologies.	Eminence, KY.	Announced plans to spend $2 million on an expansion program. The company plans to use new annealing capabilities to broaden its product lines into the area of high-carbon and alloy strip products. Expected completion date is late 1986.
Three Rivers Steel Corp.	Evansville, IN.	Plans to begin producing continuously cast thin slabs and hot-roll them into low-quality steel sheet in May. The company's goal is to cast 6,000 st/month and produce sheet for use by fabricating shops. When fully operational, the plant will employ 60 to 70 people.
United States Steel Corp.	Fairfield Works, Birmingham, AL.	Signed a letter of intent for Tippins Machinery Co. to build a larger and more expensive continuous slab caster at Fairfield Works than announced by U.S. Steel last fall. The caster will cost $165 million and have a capacity of about 2 million st/yr. The tentative agreement also would mean that a certain amount of the slabs produced at Fairfield will be sold to Tippin's Tuscaloosa Steel Corp. subsidiary, a new rolling mill that began operation last December.

IRON AND STEEL SLAG

Levy Co. Inc.	East Chicago, IN.	Requested approval from local air quality control officials to start operating a new slag processing plant at the LTV Steel Co. plant in East Chicago. The state-of-the-art plant is designed to recover metals while processing 700 st/h of slag to produce aggregate for the construction industry. Levy currently processes slag from the United States Steel Corp. and Bethlehem Steel Corp.

LEAD

Homestake Mining Co.	Buick Mine and mill and Boss smelter refinery, MO.	Announced that it had reached an agreement with AMAX Inc. to buy Amax's 50% share of the facilities for $10 million. (See Minerals and Materials, Feb./March 1986, p.14). Homestake's subsidiary, Missouri Homestake Lead Co., will assume operational control of the facilities on June 1, but the complex was immediately shut down for a minimum of 3 months to revise operational plans. Only 45 out of a total of 575 employees were retained for interim care and maintenance, but most will be recalled when production resumes.

LEAD, SILVER, ZINC		
Cominco American.	Red Dog Mine, AK.	Reached an agreement with the Alaska Industry Development Authority for financing the project's transportation system. This will allow construction to begin on a road to port facilities to be constructed on the Chukchi Sea. The accord was too late for the 1986 road construction season, however, and probably will cause initial production to be delayed 1 yr until 1991. The mine will be the world's largest zinc producer if proposed capacity is achieved.
PHOSPHATE		
Chevron Resources Co.	North of Vernal, UT.	Began operation of a new phosphate mill and a 96-mile slurry pipeline to a new fertilizer plant in Wyoming. Production at the Vernal facilities is expected to increase to 1.2 million mt/yr with the $250 million expansion project that included upgrading mining equipment, tripling input crushing capacity, installing a new mill, and enlarging the tailings area. Employment at the operation will rise from 125 to 180 when the expansion is completed.
Gardinier Inc.	Fort Meade mine and Hillsborough County chemical plant, FL.	Recalled 150 workers at the mine and 230 workers at the chemical plant after reaching a contract agreement with the International Chemical Workers at the plant. The company plans to return to 70% of its production capacity.
POTASH		
AMAX Chemical Corp.	Carlsbad, NM.	Reopened potash mine April 1 following contract ratification for a reduced wage rate by the USW. The mine was shut down Oct. 7, 1985, because of depressed market conditions. Approximately 225 of 265 employees laid off when the mine closed will be called back. Possibly important in the decision to resume mining was the U.S. Department of the Interior's agreement to cut bond requirements and royalty rates for potash companies that are operating at or near a loss. The New Mexico State Land Office is also studying the possibility of lowering State royalty rates on potash.
SALT BRINE		
LCP Chemicals & Plastics Inc.	Onondaga County, NY.	A public hearing on a $4.5 million land use development project proposed by the company is planned by the New York State Urban Development Corporation. The project calls for the takeover by LCP of salt brine mining and pipeline operations previously run by Allied Signal Inc.
SAND AND GRAVEL, CRUSHED STONE		
Martin Marietta Corp.	Various locations, IA, and Rock Springs, WI.	Acquired Weaver Construction Co., a leading producer of crushed stone and sand and gravel in Iowa. All quarries owned previously by Weaver will be operated by Martin Marietta Aggregates. Martin Marietta is the 2d largest producer of crushed stone and the 20th largest producer of sand and gravel in the United States, with more than 100 operations in the Midwest and Southeast.
SAND AND GRAVEL, MAGNESIUM		
Reserve Oil & Minerals Corp.	Ravensdale and Chewelah, WA.	Announced acquisition through its wholly owned subsidiary, L-Bar Products Inc., of Industrial Minerals Products Inc. Purchase price was about $5 million. The acquisition includes the silica sand operation at Ravensdale and a secondary magnesium recovery operation at Chewelah.
SILICA SAND		
United States Borax and Chemical Corp. (subsidiary of Rio Tinto Zinc Corp of the United Kingdom).	Various locations in California, Connecticut, Illinois, Louisiana, Michigan, and Texas.	Purchased the Ottawa Silica Co of Illinois for $46 million. This acquisition, together with its 1985 purchase of the Pennsylvania Glass Sand Co., makes Rio Tinto the largest supplier of industrial silica sand in the United States.
STONE, CRUSHED		
TXTX Corp.	Port Arthur, TX.	Announced that Foster Yeoman Ltd. of Somerset, England, will start shipping crushed granite to Houston, TX, this spring. TXTX Corp. will be the exclusive importer and distributor for Texas, Louisiana, Mississippi, and Alabama of aggregates produced at the Glensanda quarry in Scotland. The location of the quarry on a peninsula in the Scottish Highlands allows the producer to take advantage of favorable bulk carrier shipping rates.
TALC		
Acqui-Tal Inc. and Vermont Talc Co.	Johnson and Chester, VT.	Announced merger of the 2 companies. The move allows Vermont Talc to process a finer grade of talc for use in the cosmetic, pharmaceutical, and paper industries. Talc mined in Chester is shipped to the mill in Johnson.

TITANIUM		
Titanium Metals Corp. of America, Timet Division.	Pittsburgh, PA.	Concluded a 10-yr agreement with Nippon Steel Corp. of Japan to sell titanium alloy ingot to Nippon and to supply Nippon with titanium rolling technology for use in new facilities at the Yahata Works and Hirohata Works, to be completed in 1987. Under the agreement, Nippon becomes Timet's exclusive sales agent in Japan for aerospace-grade titanium mill products.
TUNGSTEN AND VANADIUM		
Strategic Minerals Corp.	Various locations.	Took over the tungsten and vanadium assets of Umetco Minerals Corp. on May 13. Umetco, a subsidiary of Union Carbide Corp., had been for sale since July 1984. Strategic Minerals Corp. was formed in January by former Umetco employees after Union Carbide sold Umetco's chromium assets in the Republic of South Africa to General Mining Union Corp. Ltd. The new company's holdings include the vanadium mine and mill at Brits, Republic of South Africa, the vanadium mine and mill at Hot Springs, AR, the tungsten mine and mill at Bishop, CA, and the tungsten and vanadium processing plant at Niagara Falls, NY. Umetco will retain its uranium mines and concentrators at Uravan, CO, and Gas Hills, WY, as well as its 70% interest in the uranium-vanadium mill at Blanding, UT.
URANIUM		
Rocky Mountain Energy Co. (RME) and Taiwan Power Company.	Arizona, Nebraska, Texas, and Wyoming.	Concluding negotiations for a 5-yr, $25 million cooperative effort to explore for uranium in the United States. RME, a subsidiary of Union Pacific Corp., will bear 2/3 of the cost of the project, and receive 2/3 ownership in any uranium claims and finds.

SELECTED NEW CONTRACTS, INVESTMENTS, EXPANSIONS, AND EXPLORATION ACTIVITIES: INTERNATIONAL

COUNTRY Commodity and Company	Operation and/or Location	Notes
AUSTRALIA		
NICKEL		
Queensland Nickel Pty. Ltd.	Yabulu refinery.	Began testing ore from New Caledonia for possible processing at the refinery. Its present feed source, the Greenvale Mine in Queensland, will be exhausted in 2 to 5 yr.
ZIRCONIUM DIOXIDE		
ICI Australia and the Commonwealth Scientific and Industrial Research Organization (Australia's national science agency).	Melbourne, Victoria.	Announced plans to manufacture zirconium dioxide (zirconia) in Australia. Previously, Australia exported all its zirconium concentrate production from the country's mineral sands operations and then bought back the processed zirconia. The planned A$12.5 million production plant will be located in Western Australia and is expected to produce 2,000 mt of zirconia by 1987. A A$500,000 pilot plant was recently commissioned in Melbourne. Zirconia is used primarily in the refractory-ceramics industry.
BELGIUM		
COBALT		
Metallurgie Hoboken-Overpelt SA.	Hoboken - Antwerp.	Announced plans to open a new facility to supplement its line of cobalt products. Feedstock for the plant will consist of cobalt-containing scrap and complex residues, including spent catalysts. The plant will have the capacity to produce 2 million lb/yr of cobalt in the form of powders, oxides, and salts.
CANADA		
MAGNESIUM		
Aluminum Co. of America (U.S.) and MPLC Holdings S.A. (Monaco).	Aldershyde, Alberta.	Announced a joint venture to build a $270 million primary magnesium plant near Aldershyde. The plant is expected to be built in 3 phases. The 1st phase, scheduled for completion in 1988, will result in a production capacity of 10,000 mt/yr. The new plant will use a MPLC-developed process that converts magnesite directly to molten anhydrous magnesium chloride, rather than using seawater or dolomite as raw materials.
Candol Development Ltd.	Southwest British Columbia.	Plans to construct a 20,000 mt/yr primary magnesium plant by the end of 1988. The company reportedly has large reserves of dolomite, which would be used as a raw material for the plant.

CHILE

COPPER

Cia. Minera Disputada de Las Condes S.A. (subsidiary of Exxon).	El Soldado copper mine.	Announced plans to double mine and mill capacity to 60,000 mt/yr of fine copper by 1987. Backup studies for this work will include 50,000 m of exploration drilling. Ore reserves are estimated at 27 million mt, with an average ore grade of 1.5% copper.

CHINA

BAUXITE

State.	Guangxi Autonomous Region.	China is soliciting foreign assistance in developing a large, rich bauxite deposit near Pingguo County. Reserves of bauxite at Pingguo exceed 200 million mt. Bauxite occurrences are distributed over several hundred kilometers encompassing the mining areas of Nadou, Taiping, Jiaomei, Xinan, and Ghouhua. Initial site preparation is underway along 4 km on the upper reaches of the You Jiang. The Pingguo bauxite project has generated interest from companies in France, Japan, and the United Kingdom.

IRON AND STEEL

State.	Anshan Steel Mill, Liaoning.	Awarded $83 million contract to Kobe Steel Ltd. for a 2-million-mt/yr, 2-strand continuous caster to be operational in 1990.
"	Ningbo, Zhejiang.	Planning for financing and construction of new 3-million-mt/yr steel mill. China seeks 80% to 90% foreign financing for the project, which is estimated to require $3 to $4 billion.

SODA ASH

State.	Tangshan, Hebei.	Began construction in April of a 600,000-mt/yr soda ash plant. China imported 1.1 million mt of soda ash in 1985, the bulk of which was from the United States. Since 1981, China has imported large quantities of soda ash because of increased consumption in glass manufacture, primarily for use in its rapidly expanding construction and motor vehicle industries.

GUYANA AND VENEZUELA

BAUXITE

Governments.	See notes.	The Governments of Venezuela and Guyana have concluded a 2-yr sales agreement that provides for the exchange of Venezuelan oil for Guyanese bauxite. Venezuela will be dependent upon imported bauxite to supply its 1-million-mt/yr Interalumina refinery until 1988, when the new Los Pijiguaos bauxite mine on the Orinoco River is to start production. Guyana is totally reliant on imported oil for use in calcining its specialty bauxite for export to the abrasives and refractories markets. Of the 2.3 million mt of bauxite consumed by Interalumina in 1985, Guyana supplied about 300,000 mt. Under the new agreement, Guyana is expected to supply a larger share.

KOREA, REPUBLIC OF

TITANIUM

Lucky Advanced Materials Inc. (LAM Inc.).	Samilmyon, Yochon, Cholla-namdo.	Began construction of a facility to produce titanium tetrachloride from imported rutile. The titanium tetrachloride will be used initially to produce 30,000 mt/yr titanium dioxide pigment. LAM Inc. also plans in the future to use part of the output of titanium tetrachloride for the production of titanium metal. Under a licensing agreement concluded in December 1985, LAM Inc. will use titanium tetrachloride production technology provided by Kerr-McGee Chemical Corp. of the United States.

MADAGASCAR

TITANIUM

QIT-Fer et Titane Inc. (Montreal, Canada).	Eastern coastal region.	Announced a joint venture with the Government of Madagascar to develop beach sand deposits on Madagascar's east coast. Plans to produce 300,000 mt/yr ilmenite concentrate could be implemented by yearend 1989. The ilmenite would be smelted at QIT's Canadian facilities to provide 200,000 mt/yr of 90% titanium dioxide slag as well as high-purity iron. The slag would be suitable for use in either the chloride or sulfate process for the manufacture of titanium dioxide pigment, and could increase the world supply of titanium dioxide in concentrates by about 6%.

PERU

COPPER, LEAD, ZINC, SILVER

Centromin.	All mining units and La Oroya metallurgical complex.	Strike that began on Feb. 24 was settled on Apr. 14.

SOUTH AFRICA, REPUBLIC OF

FERROCHROMIUM

Batlhako Ferrochrome (Pty) Ltd.	Western Transvaal, near Rustenburg.	Announced plans to begin production from a new ferrochrome plant at the end of 1986.

GOLD		
Boshoff Mines & General Investments Ltd.	Waverly gold mine.	Announced plans to increase capacity of its Glencairn heap leaching plant, commissioned in January, from 22,000 to 44,000 mt/month. The company also plans to construct a new plant to treat old gold-bearing sand dumps at the mine site.
SOVIET UNION		
IRON AND STEEL		
State.	Cherepovets.	Reported the first output from its new 5,500-m^3 blast furnace in April. The new furnace, which can produce 4.5 million mt/yr pig iron, is the largest in the Soviet Union. It was built as part of a program to retool and upgrade the country's blast furnaces. The Soviets hope to increase production efficiency and reduce the consumption of coke, which is in short supply. They plan to phase out all small blast furnaces of under 2,000-m^3 capacity; these furnaces now account for about 35% of the country's pig iron production.
THAILAND		
COLUMBIUM AND TANTALUM		
Metal Mining Agency of Japan.	Location to be decided.	Plans to build a test plant, at the request of the Thai Government, aimed at developing a technique to separate and extract columbium, tantalum, and other rare metals contained in waste derived from milling tin ores. The plant, planned for completion in the first half of 1987, will have capacity to treat 1 mt/d of waste. If the test is successful, Japan and Thailand will enter into a joint venture to construct a commercial plant, probably in 1989.
UNITED KINGDOM		
ALUMINUM		
British Alcan Aluminum (Ltd.).	Kitts' Green, near Birmingham.	Started commercial casting center for production of aluminum-lithium alloy shapes for aircraft structural components.
LITHIUM		
Lithium Corp. of Europe (subsidiary of Lithium Corp. of America).	Bromborough near Liverpool.	Expanded its lithium metal and lithium chloride production capacity. New demand for lithium was expected as an ingredient in lighter, stronger aluminum alloys for aircraft structural components.
TIN		
Capper Pass Ltd. (subsidiary of Rio Tinto Zinc Corp.).	North Ferriby, North Humberside near Hull.	Increased the capacity of Britain's only tin smelting complex by 1/3 to 20,000 mt/yr.

SELECTED CLOSINGS, POSTPONEMENTS, LAYOFFS, AND PRODUCTION DECREASES: UNITED STATES

Commodity and Company	Operation and/or Location	Notes
ANTIMONY		
ASARCO Incorporated.	El Paso, TX.	Closed its antimony metal plant indefinitely as part of an effort to cut costs and reduce operations. Starting in May, silver-copper-antimony concentrates from Asarco's Coeur Mine in Idaho are to be diverted to East Helena, MT, for evaluation of a new process for separating antimony. Until recently, Coeur Mine concentrates had been shipped to El Paso for recovery of antimony metal. At East Helena, the antimony contained in these concentrates will be mixed into lead bullion, which will then be shipped to Asarco's Omaha, NE, refinery, where the antimony will be recovered as antimony oxide.
ASBESTOS		
Vermont Asbestos Group Inc. (VAG).	Lowell, VT.	Announced plans to permanently close its asbestos mine this year as a result of EPA's decision to ban asbestos for certain uses. Although about 50% of VAG's sales are to foreign markets, increasing awareness of the health hazards of asbestos is beginning to slow foreign sales. The Vermont mine is 1 of only 3 in the United States. The other 2 U.S. mines are in California.
BAUXITE		
Norton-Alcoa Proppants.	Fort Smith, AR.	Laid off 52 workers as a result of the drop in world oil prices. Proppant production, begun last July after a $50 million expansion at the facilities, has been suspended indefinitely. Also affected are Alcoa's Bauxite operations, which had anticipated supplying 40,000 mt of product in 1986. Proppants produced at the Norton-Alcoa plant are made from calcined, low-iron, low-silica, abrasive-grade bauxite supplied by Alcoa's Bauxite, AR, mine and plant.

BORON		
American Borate Co.	Billie Mine, Death Valley National Monument, CA.	Closed the mine on Apr. 11. This was the only mine in the United States producing colemanite, a mineral that can substitute for energy-intensive borax and boric acid in glass manufacture. The closure resulted from high operating costs associated with regulations governing mining within the National Monument.
FERROALLOYS		
Foote Mineral Co., Ferroalloys Div.	Keokuk, IA.	About 150 union workers went on strike May 2; salaried employees are operating 1 of 2 furnaces at the plant which produces 50% ferrosilicon and silvery pig iron.
GRAPHITE, SYNTHETIC		
Hercules Aerospace Co. of Hercules Inc.	Bacchus, UT.	Began a 10-month process of trimming 800 employees from its 5,500-person work force at the Bacchus Works, in late April. As a result of the phaseout of the Trident missile, Hercules is in a transition phase from the production of rocket motors to the development of new products. Other reasons included slower-than-planned deliveries of the Pershing II missiles and the temporary hold in the space shuttle program in the aftermath of the Challenger disaster.
IODINE		
The Dow Chemical Co.	Midland, MI.	Shut down production of iodine on Apr. 30. Plant capacity was reported at 500,000 lb, or about 18% of domestic nameplate capacity for iodine.
IRON AND STEEL		
Cleveland-Cliffs Iron Co.	Tilden Mine, Ishpeming, MI.	Announced plans to shut down for 10 to 11 weeks beginning in late August or early September. The temporary shutdown will reduce scheduled production for 1986 from 5.3 to 4.0 million lt of iron ore pellets. On May 10, the first of 120 employees was laid off indefinitely. The iron ore operation employed 900 workers at the end of April and has the capacity to produce 8.0 million st/yr of pellets. Tilden has been operating at only 66% of capacity because of the continuing adverse impact of steel imports on domestic blast furnace operations.
Erie Mining Co.	Hoyt Lakes, MN.	Began cutting back taconite pellet production on May 18 by shutting down 4 of its 16 active furnaces. The cutback was necessitated by an oversupply of pellets. Initially 95 workers were laid off.
Lynchburg Foundry Co. (subsidiary of Intermet Corp.).	Radford, VA.	Announced the closing of its Medium Casting Foundry as of June 30, resulting in the loss of 175 jobs. The foundry, operating at 25% to 40% capacity in recent years, was consistently unprofitable. The foundry's pipeworks department closed in 1980, eliminating about 275 jobs.
United States Steel Corp.	Birmingham, AL.	Shut down pipe mill temporarily, idling about 500 workers. Much of the mill's production is used in oil well drilling, and restarting will depend on the market.
"	Homestead, PA.	Ceased production of structural steel as of May 24. Production of structural steel will be centralized at the company's South Works, near Chicago, which is considered more efficient. About 350 workers remaining at the plant will be affected.
LEAD		
ASARCO Incorporated.	East Helena, MT.	Laid off 30 of a total of 311 employees on Apr. 14 and cut work week at the lead-zinc smelter from 7 to 5 days. A shortage of lead concentrates because of the closure of Hecla's Lucky Friday silver-lead mine was cited as the reason for the reduction.
NICKEL		
M. A. Hanna Co.	Riddle, OR.	Smelter remained closed while technical difficulties in the new ore transportation system were ironed out. The smelter was closed in June 1985 for installation of a wet ore screening system and the ore transportation system.
PHOSPHATE		
Chevron Resources Co.	Garfield, UT.	Fertilizer operations were phased out during April and May and the plant prepared for selling or dismantling.
International Minerals & Chemical Corp.	Various locations in Florida.	Announced plans to shut down all its Florida mining operations, starting May 19, for 6 weeks. Rising inventories, the result of the ailing farm economy, are blamed for the closing, which resulted in the temporary layoff of 400 workers.

PHOSPHORUS		
Stauffer Chemical Co.	Silver Bow, MT.	Laid off 35 workers out of a total work force of 200 on Apr. 29. A declining market and overstocked phosphorus inventories were responsible for the layoff.
PLATINUM-GROUP METALS		
American Telephone & Telegraph Co.	Company wide.	Announced plans to sever most of is business ties with the Republic of South Africa, keeping only its long-distance service. The company will not renew its contract with Impala Platinum Ltd. for the purchase of platinum and palladium, but instead will rely on recycling existing supplies to fill its needs. In 1985 AT&T purchased South African platinum and palladium valued at over $5 million, which it used in switching devices and in electronic circuitry. AT&T has substantial inventories of palladium; however, it is likely that the company will eventually need to purchase more palladium from other primary sources, most likely the Soviet Union, the world's largest producer of palladium.
SALT		
Morton Salt Co.	Hutchinson, KS.	Reduced the work week at its plant to 3 or 4 d/wk and placed 15 to 20 workers on temporary layoff status because of slack demand.
SILVER		
Clayton Silver Mines Inc.	Clayton Silver Mine, ID.	Shut down indefinitely on May 24, putting 35 employees out of work. The mine, which had been in continuous production since 1935, shut down despite a recent reduction in mining costs and an increase in production from 225 to 350 st/d. The company indicated that it was spending about $6 for every troy ounce of silver it produced; silver sells for about $5/tr oz.
Hecla Mining Co.	Lucky Friday Mine, Mullan, ID.	Shut down indefinitely on Apr. 12, because of continued low silver prices. Closure put 247 production employees out of work; salary cuts were imposed on management employees. Limited exploration drilling will be continued at the Lucky Friday and at the company's Consolidated Silver project, near Osburn.
Sunshine Mining Co.	Sunshine Mine, Big Creek, ID.	Shut down indefinitely on Apr. 17, idling 400 hourly and 21 salaried employees. Closure could last from 1 to 3 yr unless a drastic improvement in silver prices occurs. The silver refinery is operating part time on ore from Sunshine's 16-to-1 Mine in Nevada, and on custom work.
TITANIUM		
ALS Metals Co. (joint venture of Allegheny Ludlum Steel (50%) Sumitomo Metal Industry Ltd. (40%), Sumitomo Corp. (5%) and Sumitomo U.S. (5%)).	Allegheny Ludlum Steel Corp. plants at Brackenridge and West Leechburg, PA, and Claremore, OK.	ALS reported it has stopped accepting orders because of the volatility of the yen-to-dollar currency exchange rate and will close permanently after fulfilling current contracts and selling remaining stocks. ALS brought semi-finished, commercially pure titanium mill products into the United States from Sumitomo of Japan and converted them into sheet, strip, plate, and welded tubing at Allegheny Ludlum steel mills.
ZINC		
The New Jersey Zinc Co., Inc. (NJZ).	Sterling zinc mine, Ogdensburg, NJ.	Shut down the State's only zinc mine and laid off 60 employees. Large inventories, high operating costs, and low zinc prices were blamed for the shutdown. NJZ will rely on inventory and purchased slab zinc, residues, and scrap to feed its Palmerton, PA, plant.

SELECTED CLOSINGS, POSTPONEMENTS, LAYOFFS, AND PRODUCTION DECREASES: INTERNATIONAL

COUNTRY Commodity and Company	Operation and/or Location	Notes
ANGOLA		
DIAMONDS		
Andrada Diamond Division.	Northeast Angola.	Unita rebel forces destroyed the Andrada Diamond Division in March 1986, and are continuing their attacks on major portions of diamond-bearing areas in northeast Angola. Andrada accounted for about one-third of Angola's total 1985 diamond production. Diamonds have been the 2d major source of income for Angola, following crude petroleum.
AUSTRALIA		
NICKEL		
Western Mining Corp.	Mines in Western Australia.	Shut down 5 of its 11 mines because of depressed nickel prices. The move was expected to cut annual production by 10%. The action caused a strike among workers that began Apr. 4 and was settled on May 19.

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CANADA		
IRON AND STEEL		
The Algoma Steel Corp. Ltd.	Sault Ste. Marie, Ontario.	Announced plans to reduce capacity from 3.5 million mt/yr to 2.5 million mt/yr by phasing out parts of the plant. All ingot casting will be stopped.
DOMINICAN REPUBLIC		
NICKEL		
Falconbridge Dominican C. por A.	Ferronickel smelter, Bonao.	Workers were on strike from Apr. 1 to May 7, resulting in lost production of 3 million lb contained nickel in ferronickel.
JAPAN		
TITANIUM		
Nippon Soda Co. Ltd.	Nihongi.	Reduced production to 20 to 30 mt/month (10% to 15% of capacity).
Toho Titanium Co. Ltd.	Chigasaki.	Reduced production to 400 to 450 mt/month (40% to 45% of capacity).
MEXICO		
IRON AND STEEL		
Fundidora Monterrey S. A. (subsidiary of Government-owned SIDERMEX).	Monterrey, Nuevo Leon State.	Latin America's 1st steel plant was closed in May by the Mexican Government. Since nationalization in 1978, the plant has suffered from obsolete equipment, high operating costs and low productivity. Fundidora had a capacity of 1.2 million mt/yr steel and in 1985 produced 947,000 mt crude steel. The shutdown, involving 8,000 workers, is in line with the Government policy of reorganizing and rationalizing the numerous parastate industries. The shutdown comes at a time when Mexico's austerity program has reduced domestic steel demand.
ZINC		
Zincamex S.A. (96% owned by the Comision de Fomento Minero, a Government agency).	Saltillo, Coahuila State.	Shut down 30,000 mt/yr zinc refinery at the end of April. The plant closure, which eliminated 850 jobs, was forced by a 30-fold increase in natural gas prices since 1982. Mexico still retains an annual operating capacity of 277,000 mt zinc, more than enough to meet its domestic needs.
PERU		
COPPER, LEAD, SILVER, ZINC		
Cia. Mineral Del Madrigal S.A.	Caylloma, Arequipa Province.	Because of low prices and near exhaustion of reserves, St. Joe Minerals Corp. has requested Peru's approval to close its mine sooner than midyear 1986. In March 1986, production was only 40% of rated 1,000-mt/d capacity.
TUNGSTEN		
Fermin Malaga Santolalla e Hijos Nego. Minera S.A.	Pasto Bueno Mine, Ancash Dept.	Suspended a $1.3 million mine expansion and treatment project to increase capacity from 500 to 1,000 mt/d because of low market prices. Tungsten concentrate production was about 800 mt in 1985 and contained 75% tungsten trioxide.
PHILIPPINES		
NICKEL/COBALT		
Nonoc Mining and Industrial Corp.	Nonoc Island, near Surigao.	A strike, which began Mar. 20, continued through April and May. The plant is scheduled for an additional 30-d closure for capital improvements after the strike ends.
UNITED KINGDOM		
TIN		
Geevor Tin Mines Ltd.	Geevor Mine, Cornwall.	Announced mine closure due to low world market prices and high operating costs. The mine represented about 25% of British tin mining.

MINERAL DATA SERIES

ALUMINUM

CHROMIUM

COBALT

COPPER

IRON ORE

LEAD

MANGANESE

NICKEL

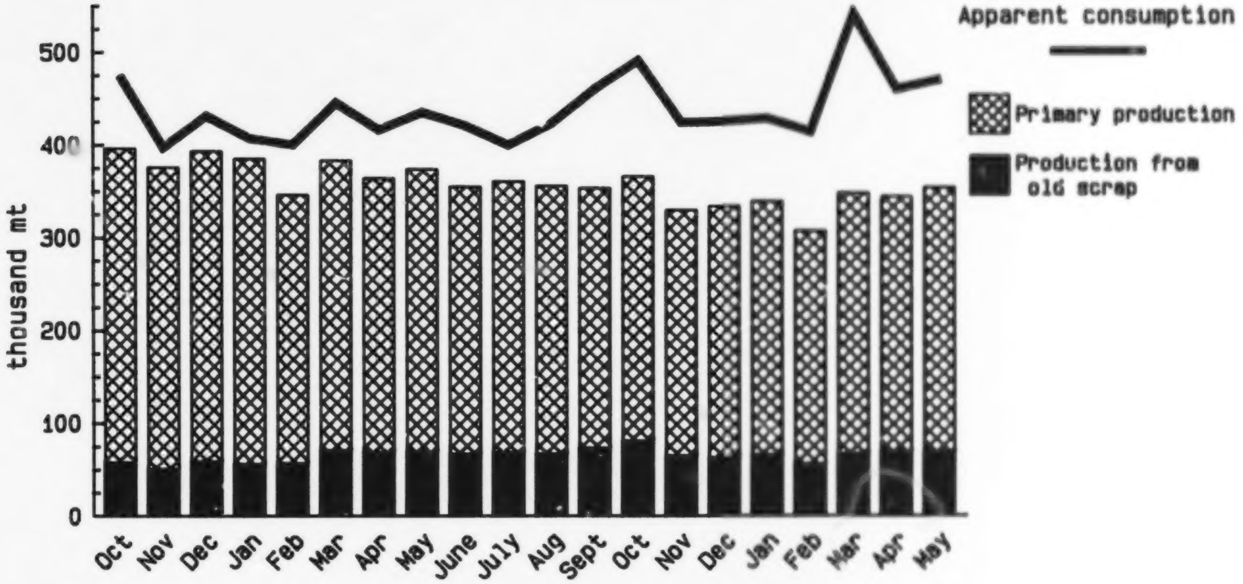
PLATINUM-GROUP METALS

STEEL

TITANIUM METAL

ZINC

ALUMINUM



October 1984 through May 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories)

			PRODUCTION				INVENTORIES		
YEAR	MONTH	APPARENT CONSUMPTION[1]	Primary	From old scrap	IMPORTS	EXPORTS	Private[2]	Government	PRICE (¢/lb)[3]
1980		4,595	4,654	617	647	1,345	2,303	2	71.6
1981		4,615	4,489	758	848	787	2,996	2	76.0
1982		4,370	3,274	782	878	748	2,812	2	76.0
1983		5,035	3,353	820	1,091	776	2,265	2	77.8
1984		5,279	4,099	825	1,477	734	2,653	2	81.0
1985		5,172	3,500	850	1,420	908	2,343	2	81.0
1984	Oct	474	338	59	140	60	2,671	2	81.0
	Nov	396	325	52	103	70	2,685	2	81.0
	Dec	431	334	60	88	83	2,653	2	81.0
1985	Jan	406[r]	329	57	117	87	2,663[r]	2	81.0
	Feb	399[r]	289	58	97	79	2,629[r]	2	81.0
	Mar	445[r]	312	72	129	76	2,621[r]	2	81.0
	Apr	415[r]	295	70	110	78	2,603[r]	2	81.0
	May	435[r]	304	71	121	75	2,589[r]	2	81.0
	June	420[r]	288	68	119	107	2,537[r]	2	81.0
	July	399	292	70	109	79	2,530[r]	2	81.0
	Aug	423[r]	289	68	113	78	2,499[r]	2	81.0
	Sept	460[r]	280	74	149	73	2,469[r]	2	81.0
	Oct	491[r]	285	82	135	65	2,415[r]	2	81.0
	Nov	423[r]	265	66	115	60	2,378[r]	2	81.0
	Dec	425[r]	271	64	106	51	2,343[r]	2	81.0
1986	Jan	428[r]	273[r]	67	131	45	2,341	2	81.0
	Feb	413	251	57	151	47	2,340	2	81.0
	Mar	541	281	68	175	34	2,289	2	81.0
	Apr	459[e]	275	70	155	45	2,285[p]	2	81.0
	May[e]	470	285	70	160	50	2,280	2	81.0

See footnotes at end of section.
Data prepared June 20, 1986.

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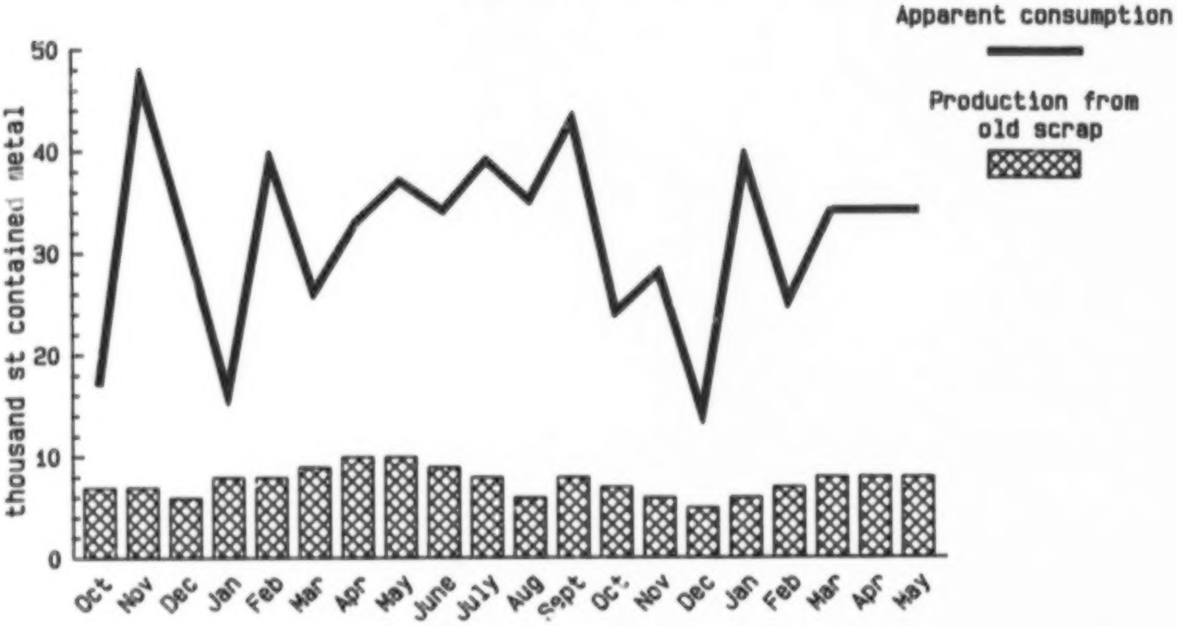
CHROMIUM



October 1984 through May 1986

Apparent consumption = primary production +
production from old scrap + (imports - exports)
+ (beginning inventories - ending inventories)

		CONSUMPTION		PRODUCTION				-INVENTORIES-		
YEAR	MONTH	Appt.	Rptd.[1]	Primary	From old scrap[2]	IMPORTS[3]	EXPORTS[3]	Private[4]	Government[5]	PRICE ($/mt)[6]
1980		587	358	0	53	461	40	250	1,325	54-58
1981		510	349	0	55	508	52	251	1,325	51-55
1982		319	232	0	48	239	10	209	1,325	48-52
1983		329	301	0	77	231	13	175	1,325	48-52
1984		437	355	0	81	332	25	118	1,325	48-52
1985[p]		378	338	0	94	304	26	112	1,325	42-45
1984	Oct	17	30	0	7	13	8	135	1,325	48-52
	Nov	47	26	0	7	34	3	126	1,325	48-52
	Dec	32	26	0	6	23	5	118	1,325	48-52
1985	Jan	16	29	0	8	18	4	124	1,325	48-52
	Feb	39	29	0	8	30	0	122	1,325	48-52
	Mar	26	30	0	9	11	0	116	1,325	48-52
	Apr	33	29	0	10	20	2	110	1,325	48-52
	May	37	31	0	10	24	0	107	1,325	40-42
	June	34	29	0	9	35	0	118	1,325	40-42
	July	39	26	0	8	34	1	120	1,325	40-42
	Aug	35	25	0	6	26	0	117	1,325	40-42
	Sept	43	26	0	8	49	19	112	1,325	40-42
	Oct	24	26	0	7	16	0	110	1,325	40-42
	Nov	28	22	0	6	27	6	109	1,325	40-42
	Dec	14	27	0	5	14	0	114	1,325	40-42
1986	Jan	39	29	0	6	54	1	133	1,325	40-42
	Feb	25	25	0	7	34	0	149	1,325	40-42
	Mar[e]	34	28	0	8	26	0	149	1,325	40-42
	Apr[e]	34	28	0	8	26	0	149	1,325	40-42
	May[e]	34	28	0	8	26	0	149	1,325	40-42

See footnotes at end of section.
Data prepared June 20, 1986.

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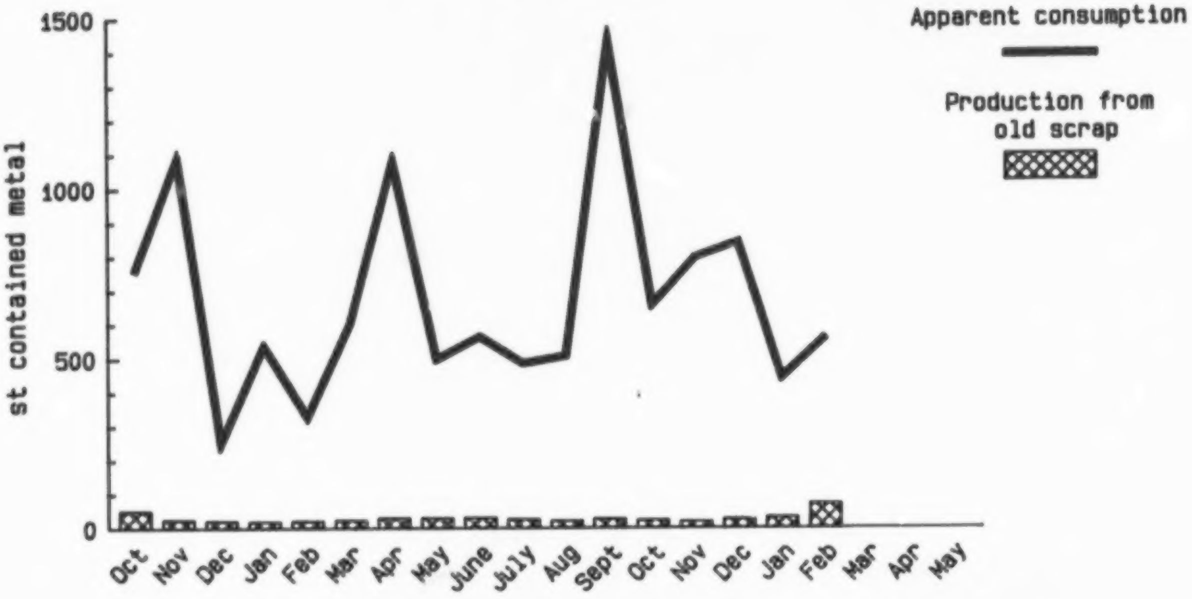
COBALT



October 1984 through May 1986

Apparent consumption = primary production +
production from old scrap + (imports - exports)
+ (beginning inventories - ending inventories)

		CONSUMPTION		PRODUCTION				-INVENTORIES-		U.S.
YEAR	MONTH	Appt.	Rptd.	Primary	From old scrap[1]	IMPORTS	EXPORTS[2]	Private[3]	Government	SPOT PRICE ($/lb)[4]
1980		8,527	7,661	0	592	8,151	292	3,753	20,401	NA
1981		6,266	5,840	0	486	7,797	417	4,188	21,566[5]	NA
1982		5,726	4,734	0	436	6,435	300	3,733	22,866	8.56
1983		7,856	5,660	0	362	8,611	412	4,305	22,998	5.76
1984		8,948[6,8]	6,472	0	440	9,950	336	5,629	23,097	10.40
1985		NA	6,771	0	333	8,854	314	NA	26,592	11.43
1984	Oct	755	514	0	55	664[7]	14	1,402	23,097	11.04
	Nov	1,087	406	0	29	1,045[7]	27	1,363	23,097	11.56
	Dec	248	485	0	25	423[7]	15	1,547	23,097	11.53
1985	Jan	536	502	0	23	431[7]	56	1,410	23,097	11.44
	Feb	323	437	0	25	253[7]	25	1,341	23,097	11.52
	Mar	603	499	0	27	534[7]	27	1,273	23,097	11.57
	Apr	1,077	503	0	33	1,103[7]	32	1,300	23,097	11.61
	May	494	486	0	33	433[7]	27	1,244	23,097	11.57
	June	564	431	0	34	547[7]	25	1,236	23,097	11.53
	July	482	352	0	29	522[7]	30	1,275	25,096	11.48
	Aug	506	403	0	24	538	33	1,297	25,096	11.45
	Sept	1,430	445	0	30	1,579	21	1,455	25,096	11.32
	Oct	655	478	0	26	650	6	1,471	25,096	11.32
	Nov	796	441	0	22	735	16	1,416	25,096	11.25
	Dec	842[6]	376	0	30	746	20	1,331	26,592	11.15
1986	Jan	440	442	0	35	561	81	1,406	26,592	10.97
	Feb	560	403	0	74	469	33	1,355	26,592	10.63
	Mar	NA	NA	0	NA	560	39	NA	26,592	10.24
	Apr	NA	NA	0	NA	396	17	NA	26,592	9.60
	May*	NA	NA	0	NA	NA	NA	NA	26,592	8.73

See footnotes at end of section.
Data prepared June 20, 1986.

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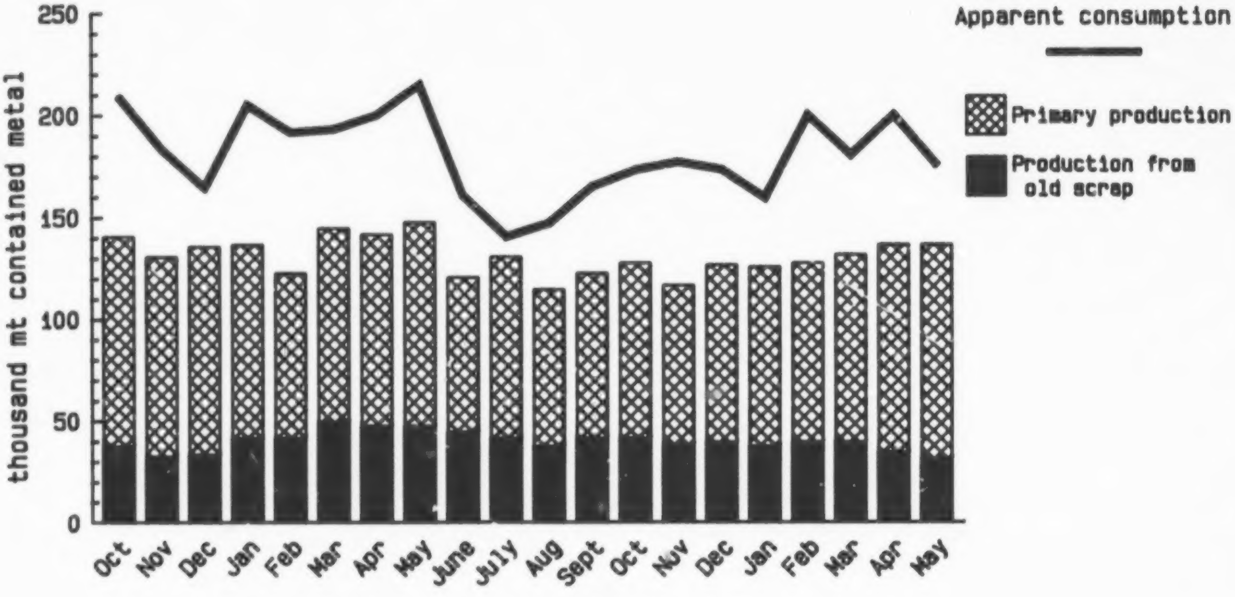
COPPER



October 1984 through May 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventcries)

			PRODUCTION[1]				INVENTORIES		
YEAR	MONTH	APPARENT CONSUMPTION	Pri-mary	From old scrap	IMPORTS[2]	EXPORTS[2]	Pri-vate[3]	Gov-ern-ment	PRICE (¢/lb)[4]
1980		2,179	1,215	613	427	14	294	20	101.3
1981		2,277	1,544	598	331	24	465	20	84.2
1982		1,762	1,227	518	258	31	676	20	72.8
1983		2,014	1,182	449	460	81	672	20	76.5
1984		2,155	1,200	465	445	91	536	20	66.8
1985		2,139	1,039	517	378	38	293	20	66.9
1984	Oct	209	103	38	49	2	565	20	62.0
	Nov	183	98	33	25	2	536	20	65.7
	Dec	164	102	34	30	2	536	20	63.5
1985	Jan	205	95	42	42	2	508	20	64.5
	Feb	191	81	42	19	3	456	20	66.5
	Mar	193	95	50	31	7	432	20	65.5
	Apr	200	94	48	22	2	393	20	70.3
	May	215	100	48	27	10	343	20	69.9
	June	160	76	45	42	3	343	20	67.1
	July	140	89	42	26	4	356	20	66.8
	Aug	147	77	33	25	5	344	20	66.3
	Sept	165	81	42	33	1	335	20	65.7
	Oct	173	86	42	19	1	308	20	66.7
	Nov	177	78	39	43	1	290	20	66.3
	Dec	173	87	40	49	1	293	20	68.0
1986	Jan	159	88	38	50	1	309	20	69.9
	Feb[e]	200	88	40	45	2	280	20	68.2
	Mar[e]	180	92	40	45	2	275	20	70.2
	Apr[e]	200	102	35	40	2	250	20	68.8
	May[e]	175	105	32	40	7	245	20	67.0

See footnotes at end of section.
Data prepared June 20, 1986.

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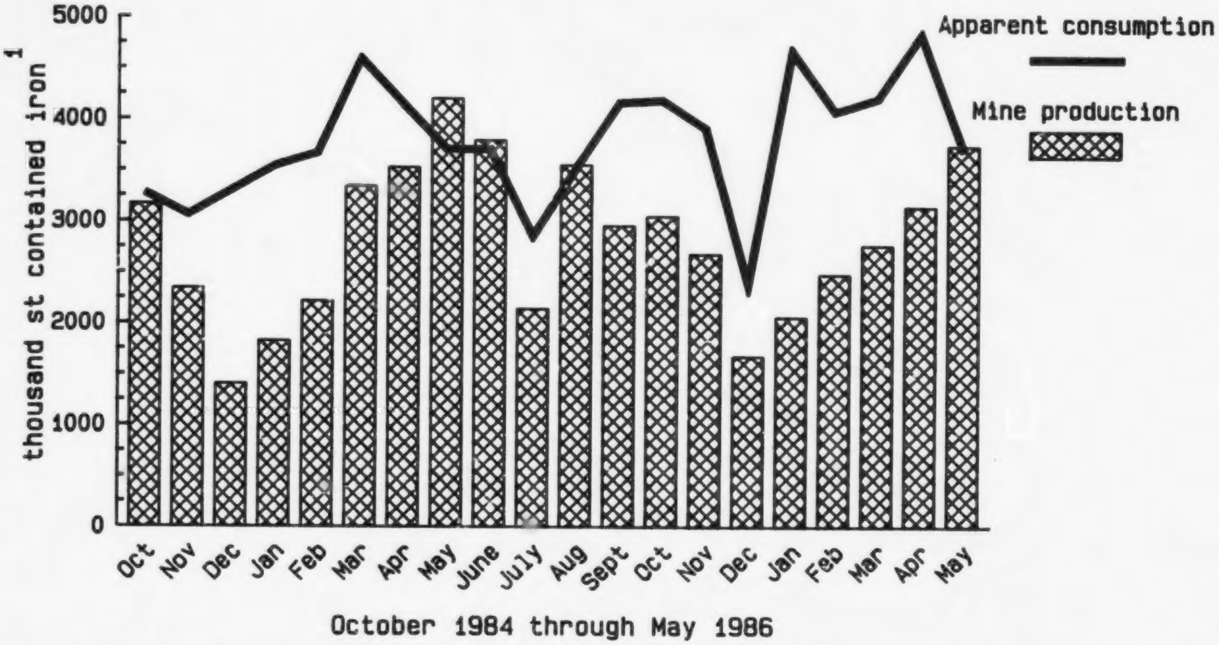
IRON ORE



Apparent consumption = mine production +
(imports - exports) +
(beginning inventories - ending inventories)

YEAR	MONTH	—CONSUMPTION— Apparent[2]	Reported[2]	MINE PRODUCTION[3]	IMPORTS	EXPORTS	INDUSTRY STOCKS[4]	PRICE ($/st)[5]
1980		63,200	63,100	49,100	17,700	4,000	38,800	65.36
1981		64,800	67,000	52,400	20,000	3,900	42,500	71.88
1982		41,800	39,300	25,400	10,250	2,300	34,100	71.88-77.20
1983		42,900[6]	43,400	27,100	9,400	2,700	23,200	71.88-77.59
1984		45,800	47,000	37,100	12,100	3,600	23,000	58.93-77.59
1985*		44,257	45,346	35,034	11,119	3,598	21,189	51.79-77.59
1984	Oct	3,260	3,395	3,175	1,099	274	23,691	71.88-77.59
	Nov	3,049	3,510	2,349	1,191	207	23,975	71.88-77.59
	Dec	3,292	3,476	1,409	1,069	270	22,891	58.93-77.59
1985	Jan	3,533	3,568	1,831	742	197	21,734	58.93-77.59
	Feb	3,663	3,584	2,223	401	0	20,695	58.93-77.59
	Mar	4,585	4,218	3,348	653	1	20,110	58.93-77.59
	Apr	4,130	4,020	3,535	682	141	20,056	58.93-77.59
	May	3,690	4,307	4,207	615	389	20,799	58.93-77.59
	June	3,696	3,854	3,798	925	478	21,348	58.93-77.59
	July	2,841	3,729	2,148	933	419	21,169	58.93-77.59
	Aug	3,518	3,694	3,558	1,178	400	21,987	58.93-77.59
	Sept	4,155	3,500	2,963	2,109	580	22,324	51.79-77.59
	Oct	4,179	3,629	3,055	920	262	21,858	51.79-77.59
	Nov	3,899	3,621	2,686	1,068	364	21,349	51.79-77.59
	Dec	2,368	3,622	1,682	893	367	21,189	51.79-77.59
1986	Jan*	4,660	3,901	2,067	912	9	19,499	51.79-77.59
	Feb*	4,061	3,710	2,487	831	0	18,756	51.79-77.59
	Mar*	4,202	3,933	2,774	813	102	18,039	51.79-77.59
	Apr*	4,829	3,864	3,152	1,018	156	17,224	51.79-77.59
	May*	3,691	4,140	3,751	918	431	17,771	51.79-77.59

See footnotes at end of section.
Data prepared June 24, 1986.

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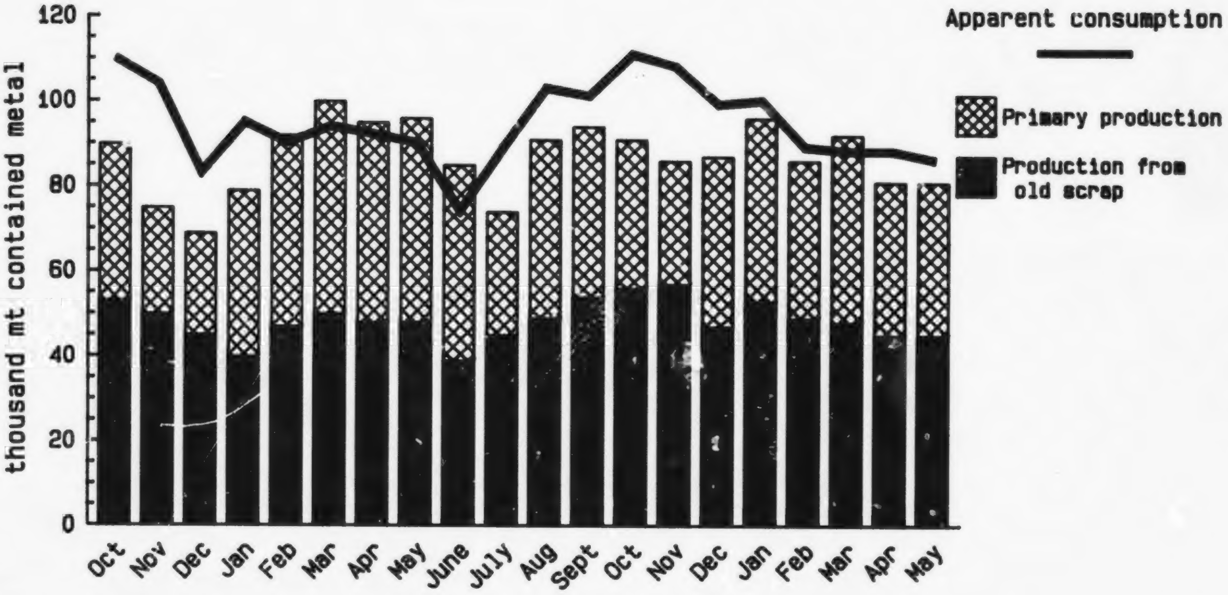
LEAD



October 1984 through May 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories)

			PRODUCTION				INVENTORIES		
YEAR	MONTH	APPARENT CONSUMPTION	Primary	From old scrap[1]	IMPORTS	EXPORTS	Private	Government	PRICE (¢/lb)
1980		1,065	548	581	82	164	181	545	42.46
1981		1,132	498	578	101	23	203	545	36.53
1982		1,109	517	521	95	56	171	545	25.54
1983		1,140	515	452	181	20	159	545	21.68
1984[r]		1,195	397	628	163	7	145	545	25.55
1985		1,153	487	594	131	27	177	545	19.07
1984	Oct[r]	110	37	53	16	1	132	545	22.33
	Nov[r]	104	25	50	16	1	118	545	25.25
	Dec[r]	83	24	45	14	1	117	545	21.89
1985	Jan[r]	95	39	40	12	0	113	545	19.09
	Feb[r]	90	45	47	11	1	125	545	18.82
	Mar[r]	94	50	50	14	2	143	545	17.68
	Apr[r]	92	47	48	11	1	156	545	19.92
	May[r]	90	48	48	9	1	170	545	20.11
	June[r]	74	46	39	8	0	189	545	19.05
	July[r]	89	29	45	8	1	181	545	18.88
	Aug[r]	103	42	49	11	7	173	545	19.10
	Sept[r]	101	40	54	12	11	167	545	19.20
	Oct[r]	111	35	56	10	2	155	545	18.93
	Nov[r]	108	29	57	14	0	147	545	19.05
	Dec[r]	99	40	47	12	1	146	545	18.97
1986	Jan[r]	100	43	53	10	1	151	545	18.35
	Feb[r]	89	37	49	12	1	159	545	17.79
	Mar[e]	88	44	48	10	3	170	545	18.20
	Apr[e]	88	36	45	10	1	172	545	18.73
	May[e]	86	36	45	8	0	175	545	19.34

See footnotes at end of section.
Data prepared June 20, 1986.

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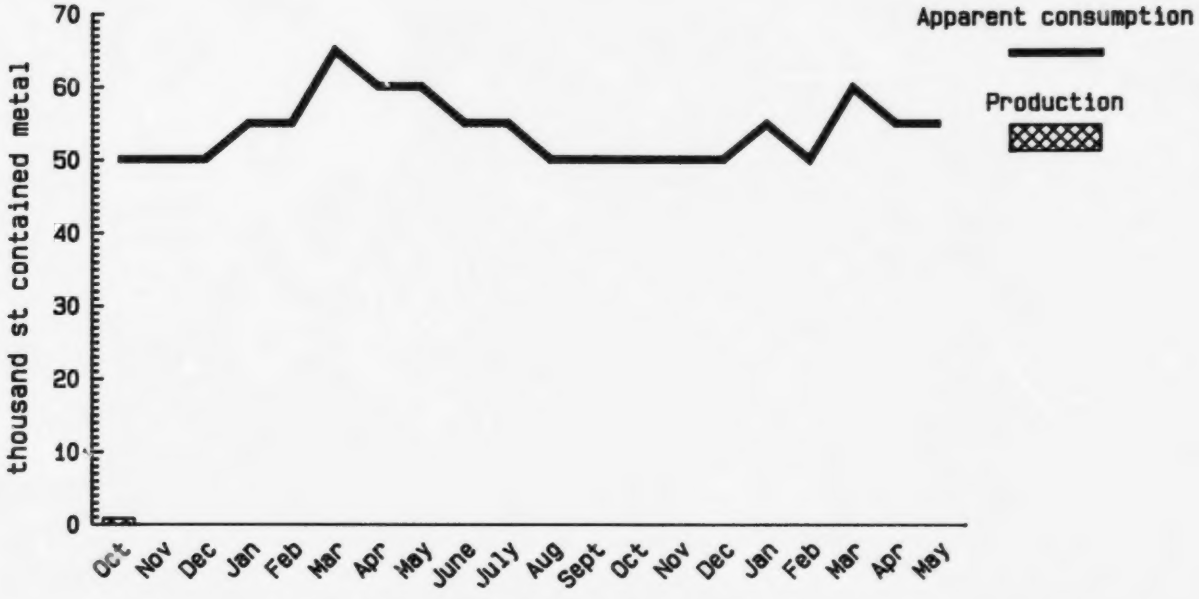
MANGANESE



October 1984 through May 1986

Apparent consumption = primary production + production from scrap + (imports - exports) + (beginning inventories - ending inventories)

			PRODUCTION				-INVENTORIES-		
YEAR	MONTH	APPARENT CONSUMPTION	Primary[1]	From old scrap	IMPORTS[2]	EXPORTS	Private[3]	Government	PRICE (\$/LTU)[4]
1980		1,029	23	0	860	52	710	2,297[5]	1.70
1981		1,027	24	0	916	49	702	2,169	1.72
1982		672	4	0	541	27	576	2,141	1.58
1983		668	4	0	542	27	462	2,206[5]	1.38
1984		627	11	0	606	43[6]	420[5]	2,197	1.42
1985[p]		NA	0	0	606	40	NA	2,106	1.43[e]
1984	Oct	50	1	0	42	35	231	2,181	NA
	Nov	50	0	0	27	8	203	2,178	NA
	Dec	50	0	0	31	1	164	2,197	NA
1985	Jan	55	0	0	34	4	244	2,185	NA
	Feb	55	0	0	50	2	238	2,184	NA
	Mar	65	0	0	61	2	241	2,175	NA
	Apr	60	0	0	84	2	267	2,171	NA
	May	60	0	0	25	8	235	2,160	NA
	June	55	0	0	45	3	229	2,153	NA
	July	55	0	0	65	1	239	2,152	NA
	Aug	50	0	0	40	4	225	2,152	NA
	Sept	50	0	0	35	6	244	2,112	NA
	Oct	50	0	0	59	2	256	2,107	NA
	Nov	50	0	0	69	1	275	2,106	NA
	Dec	50	0	0	39	5	259	2,106	NA
1986	Jan	55	0	0	67	6	281	2,090	NA
	Feb	50	0	0	90	1	322	2,088	NA
	Mar	60	0	0	45	1	307	2,087	NA
	Apr[e]	55	0	0	50	3	306	2,080	NA
	May[e]	55	0	0	50	3	302	2,076	NA

See footnotes at end of section.
Data prepared June 10, 1986.

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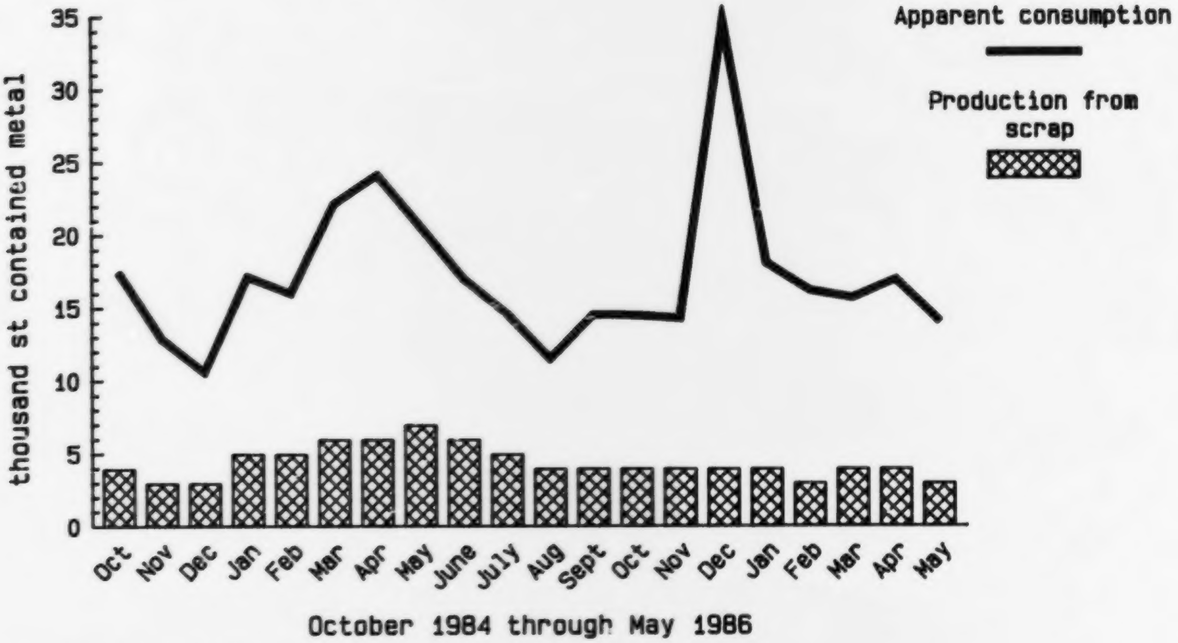
NICKEL



Apparent consumption = primary production +
production from scrap + (imports - exports) +
(beginning inventories - ending inventories)

		CONSUMPTION		PRODUCTION				INVENTORIES			PRICE[6] ($/lb)	
YEAR	MONTH	App.	Rptd.[1]	Primary[2]	From scrap[3]	IMPORTS	EXPORTS[4]	Consumer	Producer[5]	Government	Producer	U.S. spot
1980		206	156	11	49	189	20	15	60	34	3.41	2.85
1981		206	145	10	52	209	20	23	100	32	3.43	2.67
1982		181	104	3	43	130	37	19	62	32	3.20	2.24
1983		202	128	W	51	152	23	20	39	32	3.20	2.20
1984		218	137	10	58	177	28	21	37	32	3.20	2.22
1985		219	120	5	57	158	22	19	13	37	3.20	2.26
1984	Oct	17.4	12	NA	4	14	1.6	13	NA	32	3.20	2.20
	Nov	12.8	9	NA	3	12	2.2	13	NA	32	3.20	2.22
	Dec	10.5	8	NA	3	13	2.9	18	37	32	3.20	2.24
1985	Jan	17.1	10	NA	5	13	2.6	16	NA	32	3.20	2.27
	Feb	15.9	11	NA	5	11	1.4	14	NA	32	3.20	2.32
	Mar	22.1	11	NA	6	17	1.8	13	NA	32	3.20	2.36
	Apr	24.1	10	NA	6	18	1.6	12	NA	32	3.20	2.46
	May	20.5	10	NA	7	15	1.8	12	NA	32	3.20	2.51
	June	16.9	9	NA	6	13	1.8	12	NA	32	3.20	2.50
	July	14.5	8	0	5	11	2.4	11	NA	32	3.20	2.35
	Aug	11.4	8	0	4	7	1.9	9	NA	32	3.20	2.32
	Sept	14.5	8	0	4	16	2.0	9	NA	37	3.20	2.17
	Oct	14.4	8	NA	4	12	1.4	9	NA	37	3.20	2.02
	Nov	14.2	7	NA	4	12	0.3	9	NA	37	3.20	1.90
	Dec	34.7[r]	7	NA	4	15	0.4	17	13	37	3.20	1.93
1986	Jan	18.0[r]	9	NA	4	11	0.2	14[r]	NA	37	3.20	1.90
	Feb	16.1	9	NA	3	12	0.5	13	NA	37	3.20	1.88
	Mar	15.6	9	NA	4	11	0.7	11	NA	37	3.20	1.92
	Apr*	16.9	9	NA	4	13	0.2	11	NA	37	3.20	1.89
	May*	14.0	9	NA	3	11	0.2	11	NA	37	3.20	1.94

See footnotes at end of section.
Data prepared June 20, 1986.

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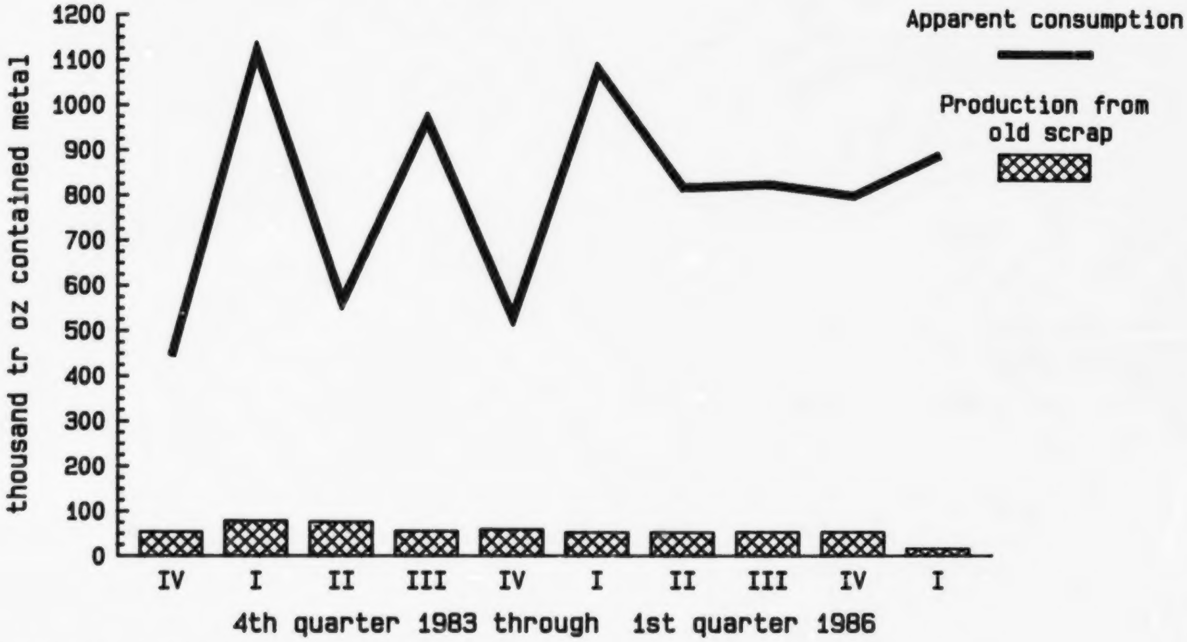
PLATINUM-GROUP METALS
(PLATINUM, PALLADIUM, IRIDIUM , OSMIUM, RHODIUM, RUTHENIUM)



Apparent consumption = primary production +
production from old scrap + (imports - exports)
+ (beginning inventories - ending inventories)

YEAR	QTR	APPARENT CONSUMPTION	PRODUCTION[1] Primary	PRODUCTION[1] From old scrap[2]	IMPORTS[3]	EXPORTS[3]	INVENTORIES Private[4]	INVENTORIES Government	PRICE ($/tr oz)[5] Pt	PRICE ($/tr oz)[5] Pd
1980		2,846	3	331	3,486	762	973	1,725	439	214
1981		2,445	7	392	2,846	855	918	1,725	475	130
1982		1,820	9	344	2,489	827	1,107	1,731	475	110
1983		2,482	9	303	3,207	1,197	943	1,735	475	130
1984		3,312[r]	24	340[r]	4,454	1,121[r]	1,319[r]	1,744	475	147
1985		3,473	5	259	3,969	885[r]	1,191[r]	1,747	475	127
1983	IV	446	NA	56	599	290	901	1,735	475	130
1984	I	1,120	NA	80	1,313	273	901	1,735	475	137
	II	563	NA	78	1,095	229	1,282	1,735	475	150
	III	968	NA	57	1,177	261	1,287	1,735	475	150
	IV	528	NA	61	869	356	1,324	1,744	475	150
1985	I	1,080	NA	54	1,148	310	1,133	1,747	475	148
	II	815	NA	54	884	232	1,024	1,747	475	120
	III	824	NA	55	965	160	1,060	1,747	475	120
	IV	797	NA	55	971	183	1,106	1,747	475	120
1986	I	888	NA	18	1,191	227	1,200	1,747	475	120

See footnotes at end of section.
Data prepared June 17, 1986.

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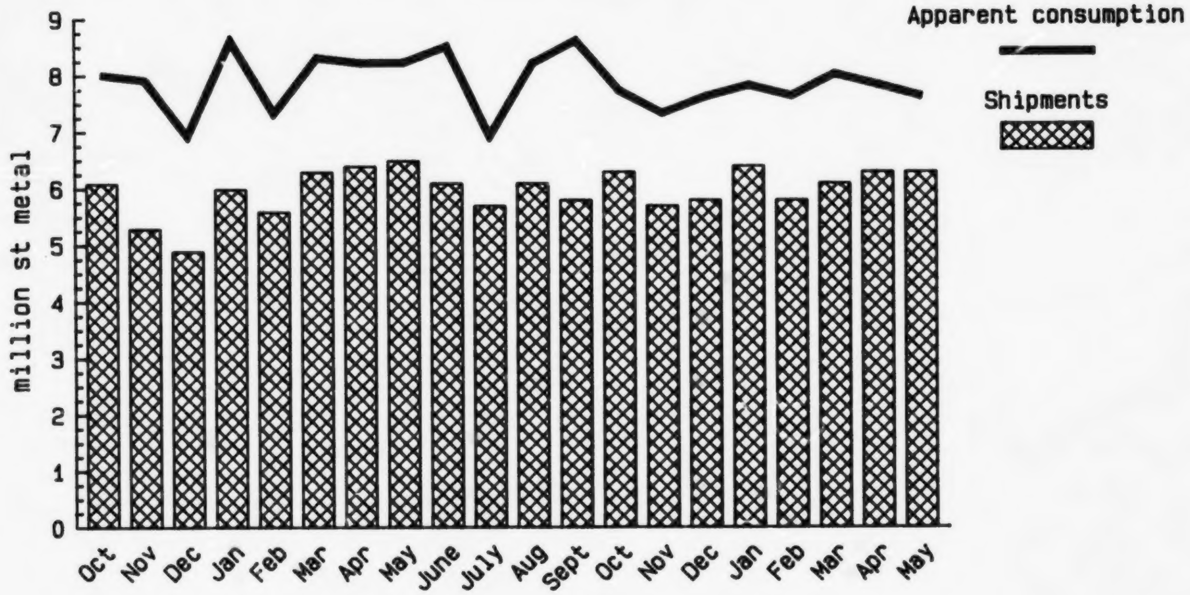
STEEL



October 1984 through May 1986

Apparent consumption = shipments +
(imports - exports) +
(beginning inventories - ending inventories) *

			STEEL MILL PRODUCTS						
							Private inventories[4]		
YEAR	MONTH	PRODUCTION OF RAW STEEL[2]	Apparent consumption	Shipments[2]	Imports[3]	Exports[3]	Steel mill[5]	Consumer and service center	PRICE ($/st)[6]
1980		111.8	98.6	83.9	15.5	4.1	16.5	11.9	434
1981		120.8	106.0	88.4	19.9	2.9	18.7	11.3	484
1982		74.6	78.8	61.6	16.5	1.8	13.4	8.8	505
1983		84.6	81.1	67.6	17.0	1.2	12.8	11.1[7]	524
1984		97.2	97.1	72.8	26.2	1.0	13.6	12.0	545
1985		88.3	95.6	72.7	24.3	0.9	13.2	12.4	552
1984	Oct	6.7	8.0	6.1	2.0	0.1	13.1	12.4	552
	Nov	6.4	7.9	5.3	2.2	0.1	13.0	12.0	552
	Dec	6.0	6.9	4.9	2.2	0.1	13.6	12.0	552
1985	Jan	7.0	8.6	6.0	2.7	0.1	13.5	12.0	552
	Feb	6.9	7.3	5.6	2.1	0.1	13.2	12.3	552
	Mar	8.3	8.3	6.3	2.0	0.1	13.7	12.3	552
	Apr	7.9	8.2	6.4	1.9	0.1	13.7	12.4	552
	May	7.8	8.2	6.5	2.0	0.1	13.6	12.6	552
	June	7.3	8.5	6.1	2.4	0.1	13.6	12.5	552
	July	7.0	6.9	5.7	1.6	0.1	13.6	12.8	552
	Aug	7.1	8.2	6.1	2.0	0.1	13.5	12.6	552
	Sept	6.9	8.6	5.8	2.5	0.1	13.3	12.3	552
	Oct	7.4	7.7	6.3	1.3	0.1	13.1	12.2	552
	Nov	7.1	7.3	5.7	1.7	0.1	13.2	12.1	552
	Dec	6.7	7.6	5.8	2.1	0.1	13.2	12.4	552
1986	Jan	7.7	7.8	6.4	1.7	0.1	13.6	12.7	492
	Feb	7.2	7.6	5.8	2.0	0.1	13.8*	12.8*	492
	Mar	7.9	8.0	6.1	2.0	0.1	13.9*	12.9*	492
	Apr*	7.8	7.8	6.3	1.6	0.1	13.8	12.9	492
	May*	7.7	7.6	6.3	1.6	0.1	13.8	13.1	492

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*Consumer and service center inventories only.
See footnotes at end of section.
Data prepared June 17, 1986.

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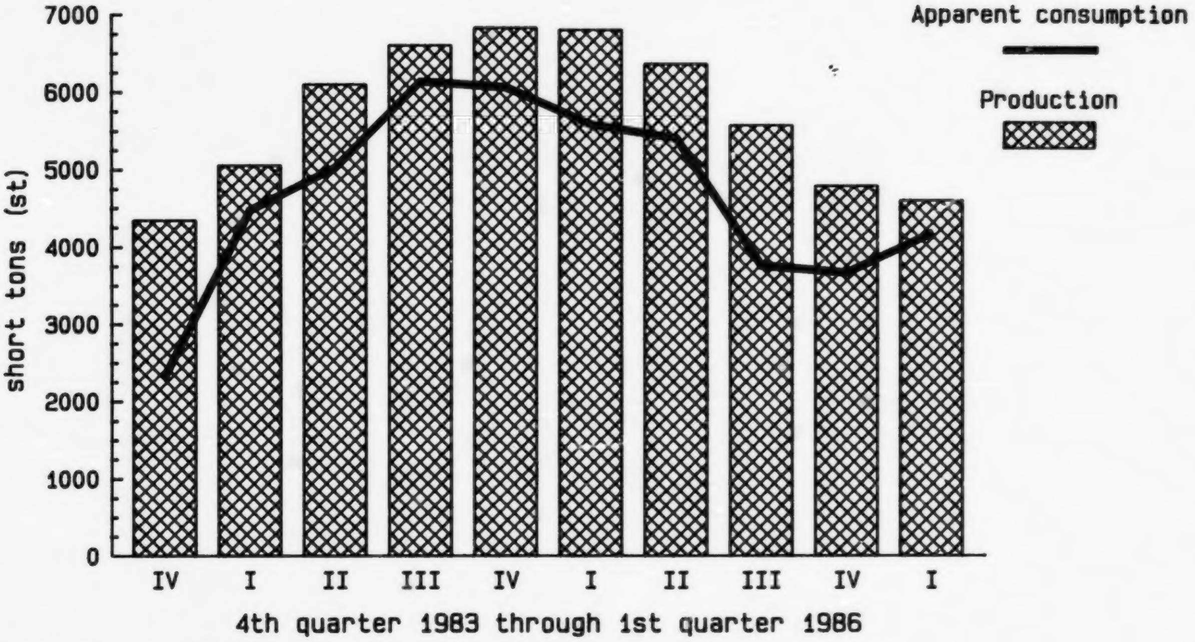
TITANIUM METAL



Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories)

YEAR	QTR	APPARENT CONSUMPTION	PRODUCTION Primary	PRODUCTION From old scrap	IMPORTS	EXPORTS	INVENTORIES Sponge[e]	INVENTORIES Other[e]	INVENTORIES Government[2]	PRICE ($/lb)[3]
1980		22,619	22,505[1]	300	10,052	8,800	2,382	10,510	32,331	5.50
1981		23,891	26,506[1]	300	11,639	9,643	3,720	14,083	32,331	7.65
1982		12,521	15,639[1]	300	3,795	8,103	3,350	13,563	32,331	5.55
1983		7,867	13,966	300	3,785	8,061	3,136	15,900	32,331	5.55
1984		21,682	24,326	300	5,533	7,333	3,147	17,033	32,470[5]	5.55
1985		18,352	23,257	300	5,478	10,388	4,755	15,720	36,831[5]	5.55
1983	IV	2,321	4,280	75	830	1,980	3,136	15,900	32,331	5.55
1984	I	4,470	4,988	75	1,221	1,828	3,312	15,710	32,331	5.55
	II	5,025	6,035	75	1,700[4]	2,142	3,553	16,112	32,331	5.55
	III	6,135	6,538	75	1,367[4]	1,450	3,835	16,225	32,331	5.55
	IV	6,052	6,765	75	1,250[4]	1,913	3,147	17,033	33,470[5]	5.55
1985	I	5,569	6,736	75	1,190	2,644	3,419	16,549	33,069[5]	5.55
	II	5,392	6,295	75	1,775	2,688	3,985	16,048	35,826[5]	5.55
	III	3,741[e]	5,505	75	1,411	2,412	4,639	16,232	36,831[e,5]	5.55
	IV	3,650[e]	4,721	75	1,102	2,644	4,755	15,720	36,831[e]	5.55
1986	I[e]	4,165	4,530	75	1,408	2,523	3,930	15,870	36,831	3.50 to 4.00

See footnotes at end of section.
Data prepared June 20, 1986.

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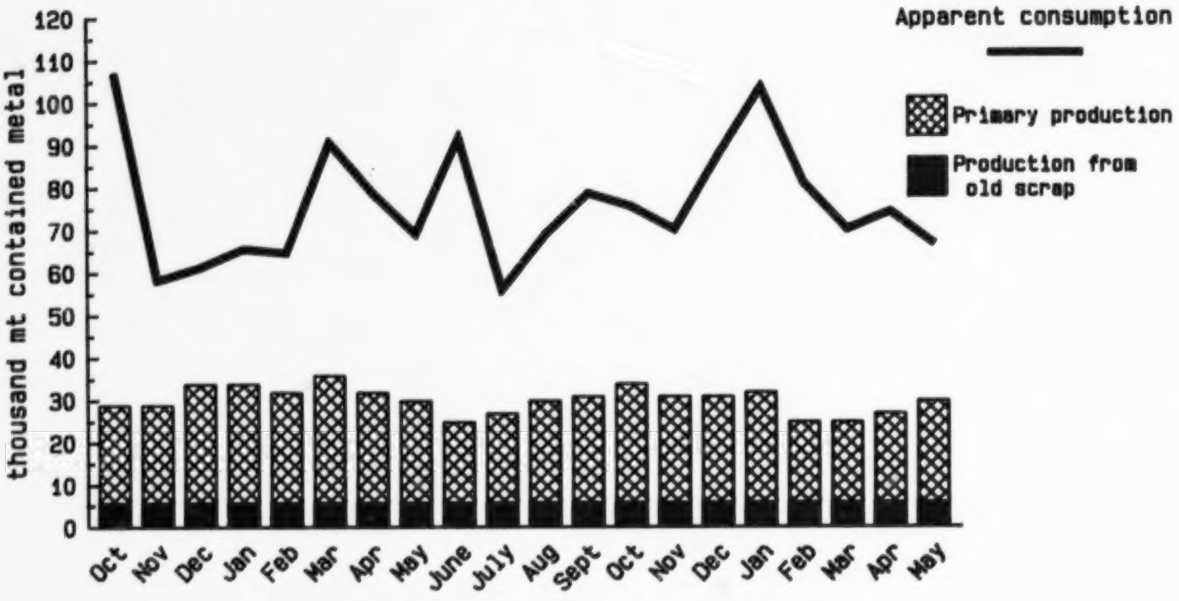
ZINC



October 1984 through May 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories)

			PRODUCTION				INVENTORIES		
YEAR	MONTH	APPARENT CONSUMPTION	Primary[1]	From old scrap[2]	IMPORTS[3]	EXPORTS[4]	Private	Government	PRICE (¢/lb)[5]
1980		842	370	66	414	34	126	342	37.4
1981		1,000	397	86	620	35	195	341	44.6
1982		844	302	62	463	19	159	341	38.5
1983		996	305	76	625	21	148	341	41.4
1984		1,027	331	81	645	40	138	341	48.6
1985[e]		952	301	72	616	45	130	341	40.4
1984	Oct	108	23	6	62	3	107	341	44.2
	Nov	63	23	6	40	2	111	341	43.6
	Dec	66	28	6	38	2	115	341	43.6
1985	Jan	70	28	6	43	2	120	341	42.9
	Feb	69	26	6	40	3	120	341	42.6
	Mar	93	30	6	52	5	110	341	43.2
	Apr	82	26	6	53	4	109	341	44.9
	May	73	24	6	41	3	104	341	45.1
	June	94	19	6	70	3	102	341	43.7
	July	61	21	6	46	3	111	341	41.4
	Aug	73	24	6	42	3	107	341	39.8
	Sept	82	25	6	54	4	106	341	37.9
	Oct	79	28	6	42	4	99	341	35.8
	Nov	74	25	6	65	8	113	341	33.4
	Dec	90	25	6	67	3	118	341	33.9
1986	Jan	105	26	6	75	4	116	341	32.9
	Feb	84	19	6	59	5	111	341	30.9
	Mar[e]	74	19	6	58	5	115	341	31.2
	Apr[e]	78	21	6	50	4	110	341	32.1
	May[e]	71	24	6	50	4	115	341	33.0

See footnotes at end of section.
Data prepared June 20, 1986.

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GENERAL NOTES

Numbers in the mineral data series are from the Bureau of Mines, except for imports and exports (Bureau of the Census) and Government inventories (General Services Administration), or as cited in the footnotes below. Inventory figures are for the end of the period.

Monthly figures are independently rounded. They exclude year-end revisions and may not add to monthly apparent consumption annual totals.

Footnotes Used

e/ = Estimate   p/ = Preliminary   r/ = Revised   W = Withheld   NA = Not available

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FOOTNOTES, BY COMMODITY

ALUMINUM

1 Aluminum metal consumption only. Nonmetallic uses of bauxite and alumina in chemical, abrasive, and refractory materials represent, on an aluminum metal equivalent, an additional 10% apparent industrial demand.

2 Source: U.S. Department of Commerce.

3 Primary producers' list prices. Annual figures are Bureau of Mines averages. Monthly figures are producers' list prices as quoted by Metals Week. The average market or spot prices quoted by Metals Week were 59.4¢/lb for April and 57.8¢/lb for May.

Note: As of the December 1985 / January 1986 issue, aluminum data are presented in metric tons rather than short tons. To convert metric tons to short tons, multiply by 1.10231.

CHROMIUM

1 Before January 1984: in alloys, by metallurgical industry, and in chromite, by refractory and chemical industries. Since January 1984: in alloys, by metallurgical industry, and in chromite, by metallurgical, chemical, and refractory industries. Estimates do not include yield losses in production or make adjustments for an incomplete industry survey.

2 Estimated chromium content of stainless steel scrap received by steel industry.

3 Chromium content of chromite and chromium alloys.

4 Producer and consumer inventories of alloys and metal and consumer inventories of ores.

5 Chromium contained in specification-grade chromite, chomium ferroalloys, and chromium metal.

6 Transvaal ore, f.o.b. South Africa.

COBALT

1 Reported consumption of purchased scrap.

2 Content of unwrought cobalt, cobalt alloys, and waste and scrap.

3 End-of-month stocks at processor and consumer establishments only for monthly data.

4 Weighted average based on weekly price quoted by Metals Week.

5 Estimated as consigned to the stockpile based on import data.

6 Apparent consumption figure does not reflect change in Government inventory; this change represents acceptance of imports that occurred prior to 1984.

7 Import figure does not include quantity of cobalt destined for stockpile.

8 Due to minor adjustments in calculation of private inventories, apparent consumption for year 1984 is not based on 1983 stock data.

COPPER

1 Refined metal and metal used in production of alloys, from domestic and foreign ores, and old scrap.

2 Unwrought refined copper.

3 Refined copper held at primary producers' plants, wire mills, brass mills, chemical plants, foundries, and miscellaneous plants, and in Commodity Exchange, Inc. warehouses.

4 U.S. producers delivered price, listed as "U.S. Producer Cathode" in Metals Week. Revised from previous quotes for wirebar.

Note: Revised as of April/May 1984 issue to delete scrap from import and export figures.

IRON ORE

1 Data estimated except for annual mine production.

2 Based on gross weights reported by American Iron Ore Association.

3 Calculated from data reported to Bureau of Mines by U.S. producers.

4 Includes usable ore reported at U.S. mines, docks, and consuming plants, end of month. After 1982, excluding byproduct ore at mines. Prior data unchanged for proprietary reasons.

5 Based on published end-of-month prices for Lake Superior iron ore pellets, delivered rail-of-vessel at lower Great Lakes ports, per LTU of iron, natural basis.

6 Due to adjustment of mine stocks (see footnote 4), apparent consumption for year 1983 is not based on December 1982 stock data.

LEAD

1 Monthly canvass adjusted to reflect annual canvass and exclude approximately 7% new scrap.

MANGANESE

1 Manganese contained in manganiferous ore.

2 Includes manganese dioxide as of 1984.

3 Producer and consumer inventories of alloys and metal and consumer inventories of ores.

4 Average price per LTU, metallurgical ore containing 46% to 48% manganese.

5 Reflects inventory adjustments.

6 Adjusted for reexports.

NICKEL

1 Primary nickel.

2 Contained nickel in ferronickel.

3 Estimated. Includes new and old scrap.

4 Exports of unwrought nickel, powder, flakes, and electrolytic anodes.

5 U.S. producer and producer's agent stocks.

6 Producer listed price of cathode nickel; yearly weighted average. Spot prices of cathode nickel; weighted average annual and monthly prices.

PLATINUM-GROUP METALS

1 Refined metal.

2 Non-tolled scrap. Breakdown between old and new scrap not available.

3 Refined metal and scrap metal.

4 Refined metal held by refiners, importers, dealers. Includes platinum and palladium in New York Mercantile Exchange warehouses.

5 Quarterly and annual averages of weekly major-producer prices.

STEEL

1 Not including iron and steel foundry products.

2 American Iron and Steel Institute (AISI).

3 Compiled by AISI from Bureau of the Census reports.

4 Steel mill shapes and forms, reported by Bureau of the Census.

5 Includes steel in process and finished steel.

6 Average composite price of finished steel, reported in Iron Age.

7 Revised series beginning in 1983.

TITANIUM METAL

1 Calculated sponge metal production = sponge consumption - sponge imports + exports and adjustments for Government and industry stock changes.

2 Usually over 75% scrap.

3 End-of-period list price for sponge through 1985; estimated sales price range in 1986. Actual sales prices from 1982 through 1985 were mainly in a range of $3.50/lb to $4.50/lb.

4 Excludes sponge imported by GSA for the Strategic Stockpile.

5 Not included in calculations of apparent consumption.

ZINC

1 Monthly production figures reported by American Bureau of Metal Statistics, Inc. (ABMS) do not include all data from companies reporting annually to Bureau of Mines.

2 Monthly old scrap figures based on a percentage of the total secondary zinc produced during the month.

3 Imports for consumption of slab zinc, fume, dross, and skimming.

4 Consists of unwrought zinc, zinc content of waste, and scrap and dross.

5 Metals Week monthly average price for High Grade zinc.

CURRENT BUREAU OF MINES PUBLICATIONS OF SPECIAL INTEREST

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MP. Mineral Industries of the Middle East, by Staff, Branch of Africa and the Middle East, Division of International Minerals. 1986. 65 pp. 32 figs. This Bureau of Mines report presents a summary of the mineral industries of the 16 countries in the Middle East. Countries in this region differ widely, from those heavily endowed with hydrocarbon resources but with limited nonfuel resources, such as Saudi Arabia, Kuwait, and Qatar, to those heavily mineralized countries with limited petroleum reserves, such as Turkey, and to those with little mineral activity of any kind, such as Lebanon. Base maps and tables show the location and salient features of each country's mineral and petroleum industries. The text highlights the important aspects of mineral supply and trade, mineral policy, industry structure, labor, energy, and the outlook for future developments in the industry. Infrastructure of importance to the mineral industry of each country, including railways, roads, and pipelines, is included on each map. Photographs of some operations are included. GPO Stock No. 024-004-02161-6. $3.50.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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BUREAU OF MINES ★ UNITED STATES DEPARTMENT OF THE INTERIOR

Minerals and Materials

COMPLETED
64

A Bimonthly Survey

June/July 1986

Fe
Pb
Ni
Ti
Cu
Mn

CONTIN

MINERALS
and
MATERIALS

A Bimonthly Survey

June/July 1986

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald Paul Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

I

FOREWORD

The U.S. economy grew at a seasonally adjusted annual rate of 0.6%, a much slower rate than expected, during the second quarter of 1986. Capital spending and trade remained weak. Although interest rates fell, industrial production continued to be sluggish.

This issue of Minerals and Materials features an article by Alan Born, President and Chief Executive Officer of Amax, on the changes that are occurring in the mining industry and how industry must respond to these changes and an article by William H. Dresher, President of the International Copper Research Association, Inc., on new copper applications and markets in historical perspective. This issue also features a graphical overview of the significant changes in aluminum production and consumption during the past 35 years.

George White, Editor
September 15, 1986

Publication Staff:
Keith Harris
Mary Hennessy
David Quick
Kim d. Young

ACKNOWLEDGMENTS

Mineral information and data are provided by the commodity and country specialists, research personnel, and State mineral officers of the Bureau of Mines.

The Bureau of Mines will consider for publication authoritative articles on any facet of mineral resource development and use. The Bureau makes no commitment to publish such articles in advance of editorial and policy reviews.

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UNIT ABBREVIATIONS

°C = degree Celsius

¢/lb = cent per pound

cm = centimeter

g/L = gram per liter

g/mt = gram per metric ton

h = hour

in = inch

kW·h = kilowatt hour

L = liter

lb = pound

lb/yr = pound per year

lt = long ton = 2,240 pounds

LTU = long ton unit: In sales of ores, concentrates or metals, a unit is 1% of the specified substance. A ton of 1% ore contains 1 unit. A ton of 48% manganese contains 48 units.

m = meter

m^3 = cubic meter

mt = metric ton = 2,204.6 pounds, 1,000 kilograms

mt/d = metric ton per day

mt/yr = metric ton per year

MW = megawatt

oz = troy ounce

oz/st = troy ounce per short ton

oz/yr = troy ounce per year

% = percent

ppm = part per million

st = short ton = 2,000 pounds

st/d = short ton per day

st/yr = short ton per year

yr = year

SECOND-QUARTER NATIONAL ECONOMIC ACTIVITY AND THIRD-QUARTER OUTLOOK

By Keith L. Harris[1]

Second-Quarter National Economic Statistics

The economy continued to expand during the second quarter, but at a much slower pace than expected. According to latest estimates released by the Department of Commerce, the real gross national product (GNP) grew at a seasonally adjusted annual rate of 0.6% compared with a revised growth rate of 3.8%[2] for the first quarter of 1986 and 2.3% for the second quarter of 1985 (table 1). The strong growth of personal consumption expenditures, Government purchases of goods and services, and residential investment was moderated by the growing trade deficit, declining investment in business inventories, and the continuing lag in nonresidential investment. Much of the decreased capital spending for the nonresidential sector for the first and second quarters resulted from reduced petroleum exploration and drilling in response to low petroleum prices.

Capital spending and trade continue to be areas of weakness for the economy. Real new plant and equipment expenditures for 1986 are estimated to be 1.3% below those of 1985 (table 2). Real net exports of goods and services decreased $24.6 billion, as exports declined 5.6% and imports grew 16.5%. About two-thirds of the $19.3 billion increase in imports was in petroleum and petroleum products, which, because of their lower prices, should help the economy in the future. In response to the sluggishness of the economy, the Federal Reserve System reduced its discount rate from 6.5% to 6% in early July. Inflation, as measured by the fixed-weighted GNP price index, declined from a revised 2.5% in the first quarter to 1.9% in the second quarter because of significantly lower energy prices.

The continuing growth of consumer expenditures has been aided by the expanding labor force. Total employment during 1986 has risen steadily, except during June, and the unemployment rate was down to 6.9% in July. Service sector employment was up 363,000 in July, and construction employment increased 53,000. The mining and manufacturing sectors continue to lose jobs, however, manufacturing lost 56,000 and 23,000 jobs in June and July, respectively, while mining lost 17,000 and 4,000, respectively, mostly in the oil and gas industry (table 3).

The sluggish economy, continuing high level of imports, and low commodity prices are hampering the performance of the industrial sector of the economy. According to the Federal Reserve Board, industrial production was off 0.1% in July, following 0.3% and 0.5% declines in June and May, respectively (table 4). Manufacturing remained steady in July after declines in both May and June. Even with these declines, manufacturing has remained above previous-year monthly output. This has not been the case with mining, which peaked in June 1985 and generally has been declining since. July mining output was about 9% below the July 1985 level. Capacity utilization rose for clay, glass, and stone and total primary metals manufacturing, but fell or remained stable in all other sectors listed in table 5.

Corporate profits fell in the second quarter from previous-year levels for the sixth quarter in a row. After-tax earnings on continuing operations of 476 major corporations fell 8% from the previous-year second quarter earnings, according to a Wall Street Journal survey.[3] Among these corporations, many steelmakers continued to report losses. The

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[1] Physical scientist, Office of Special Projects, Bureau of Mines, Washington, DC.

[2] The national income and product accounts are revised, usually in July, to incorporate new source data and updated seasonal adjustment factors. The revised estimates for GNP and corporate profits for 1983 through the first quarter of 1986 are contained in table 1.

[3] The Wall Street Journal. Corporate Profits Fell 5% in Second Quarter, Sixth Drop in a Row. Aug. 5, 1986, pp. 1, 10-11.

Table 1.—NATIONAL ECONOMIC STATISTICS[1]

	1983	1984	1985	1985 II	1985 III	1985 IV	1986 I	1986 II
Billion current dollars, except as noted								
Gross national product	3,405.7	3,765.0	3,998.1	3,965.0	4,030.5	4,087.7	4,149.2	4,179.8
Percent change from previous period[2]	7.6	10.5	6.2	5.8	6.8	5.8	6.2	3.0
Fixed-weighted price index for GNP[3]	104.1	108.2	112.3	111.9	112.6	113.7	114.4	115.0
Percent change from previous period[2]	4.1	4.0	3.7	3.6	2.8	4.0	2.5	1.9
Personal consumption expenditures	2,234.5	2,428.2	2,600.5	2,576.0	2,627.1	2,667.9	2,697.9	2,735.3
Durable goods	289.1	331.2	359.3	354.0	373.3	362.0	360.8	409.7
Nondurable goods	816.7	870.1	905.1	902.3	907.4	922.6	929.7	929.1
Services	1,128.7	1,227.0	1,336.1	1,1319.7	1,346.4	1,383.2	1,407.4	1,430.5
Gross private domestic investment	502.3	662.1	661.1	667.1	657.4	669.5	708.3	684.7
Fixed investment	509.4	598.0	650.0	648.0	654.3	672.6	664.4	672.2
Change in business inventories	-7.1	64.1	11.1	19.1	3.1	-3.1	43.8	12.5
Net exports of goods and services	-6.1	-58.7	-78.9	-77.1	-83.7	-105.3	-93.7	-100.2
Exports	352.5	382.7	369.8	370.0	362.3	368.2	374.8	367.9
Imports	358.7	441.4	448.6	447.1	446.0	473.6	468.5	468.1
Government purchases of goods and services	675.0	733.4	815.4	799.0	829.7	855.6	836.7	860.0
Federal	283.5	311.3	354.1	340.9	360.9	380.9	355.7	367.1
State and local	391.5	422.2	461.3	458.1	468.8	474.4	480.9	492.9
Final sales (GNP less change in business inventories)	3,412.8	3,700.9	3,987.0	3,945.9	4,027.4	4,090.8	4,105.4	4,167.3
Corporate profits[4]	196.7	230.2	222.6	215.4	235.3	226.4	240.8	239.8
Domestic industries	166.6	199.2	190.8	183.8	205.3	191.3	202.4	202.3
Manufacturing	70.1	87.4	73.0	68.2	79.0	74.5	67.1	NA
Primary metal industries	-4.9	-2.6	-3.6	-3.9	-2.6	-3.6	-2.6	NA
Fabricated metal products	3.0	4.6	4.1	4.6	4.5	3.0	4.7	NA
Chemicals and allied products	6.7	7.5	4.7	5.3	5.3	2.8	6.8	NA
Petroleum and coal products	21.4	17.3	13.4	7.4	17.0	18.7	7.[illegible]	NA
Rest of the world	30.2	31.0	31.8	31.6	30.0	35.1	38.4	37.5
Billion 1982 dollars, except as noted								
Gross national product	3,279.1	3,489.9	3,585.2	3,567.6	3,603.8	3,622.3	3,655.9	3,661.5
Percent change from previous period[2]	3.6	6.4	2.7	2.3	4.1	2.1	3.5	0.6
Personal consumption expenditures	2,146.0	2,246.3	2,324.5	2,311.9	2,342.0	2,351.7	2,372.7	2,410.4
Durable goods	283.1	318.9	343.9	338.8	357.4	347.0	345.4	358.8
Nondurable goods	800.2	828.6	841.6	841.3	843.8	847.2	860.6	873.1
Services	1,062.7	1,098.7	1,139.0	1,131.8	1,140.8	1,157.5	1,166.6	1,173.5
Gross private domestic investment	504.0	652.0	647.7	655.6	643.8	653.2	684.0	659.2
Fixed investment	510.4	592.8	638.6	638.1	643.1	658.4	644.1	647.5
Change in business inventories	-6.4	59.2	9.0	17.4	0.7	-5.2	39.9	11.6
Net exports of goods and services	-19.9	-83.6	-108.2	-108.1	-113.8	-132.0	-125.9	-150.5
Exports	348.1	369.7	362.3	361.2	355.8	362.9	369.2	363.9
Imports	368.1	453.2	470.5	469.3	469.6	494.8	495.1	514.4
Government purchases of goods and services	649.0	675.2	721.2	708.3	731.8	749.4	725.2	742.4
Federal	275.1	291.7	323.6	311.4	329.9	347.2	320.4	329.5
State and local	373.9	383.5	397.6	396.9	401.9	402.2	404.8	413.0
Final sales (GNP less change in business inventories)	3,285.5	3,430.7	3,576.2	3,550.2	3,603.1	3,627.5	3,616.1	3,649.8

NA Not available.

[1] Quarterly data are expressed at seasonally adjusted annual rates. The 1983 through first quarter 1986 data have been revised to incorporate new source data and updated seasonal adjustment factors. The July 1986 issue of the Department of Commerce Survey of Current Business contains the complete set of national income and product accounts tables and an article describing the revisions.

[2] Changes are based on unrounded data and so may differ slightly from changes computed from data shown here.

[3] 1982 weights, 1982 = 100.

[4] With inventory valuation adjustment and without capital consumption adjustment.

Source: U.S. Department of Commerce. News. July 22, 1986, tables 1, 2, 3, and 5; and, private communication, Aug. 22, 1986.

steelmaking operations of USX Corp. (the new name for United States Steel Corp.) reported a $42 million pre-tax operating loss, compared with a $85 million profit in the second quarter of 1985. Other major steel companies reporting losses included Armco Inc., Bethlehem Steel Corp., and Wheeling-Pittsburgh Steel Corp. Inland Steel Co. reported its first quarterly profit in 2 years but expects losses for the third quarter and full year. LTV Corp., which in addition to its many other businesses is the second largest domestic steel producer, has filed for protection from creditors under chapter 11 of the Federal Bankruptcy Code. (See related item under "U.S. Mineral Industry Highlights.)

The second quarter was brighter for some metal and mineral producers, however. The

Table 2

NEW PLANT AND EQUIPMENT EXPENDITURES BY BUSINESS

(quarters seasonally adjusted at annual rates)

	1984	1985[r]	1986[1]	1985 I	1985 II	1985 III[r]	1985 IV[r]	1986 I	1986 II[1]	1986 III[1]	1986 IV[1]
Billion current dollars											
All industry	354.44	386.41	387.25	371.16	387.83	388.90	397.74	376.08	387.42	388.87	396.61
Manufacturing	138.82	153.15	149.17	145.65	154.33	154.04	158.57	143.06	148.01	148.47	157.16
Durable goods	66.24	73.14	72.09	69.87	73.96	72.85	75.87	67.74	72.20	71.42	76.98
Primary metals	7.15	7.73	7.74	7.62	7.44	7.71	8.16	7.83	7.69	7.47	7.95
Blast furnaces	3.54	4.10	4.01	3.92	3.92	4.09	4.48	3.89	3.83	4.06	4.25
Nonferrous metals	2.13	1.88	1.87	2.00	1.76	1.85	1.90	1.87	1.80	1.74	2.06
Stone, clay, and glass	3.09	3.40	3.23	3.20	3.43	3.60	3.38	3.04	3.25	3.35	3.29
Nondurable goods	72.58	80.01	77.09	75.78	80.36	81.19	82.70	75.32	75.80	77.04	80.19
Chemicals	15.32	16.45	17.16	16.43	16.90	16.28	16.19	16.02	16.82	17.27	18.52
Nonmanufacturing	215.61	233.26	238.07	225.51	233.51	234.86	239.16	233.02	239.41	240.40	239.45
Mining	16.86	15.88	12.35	15.66	16.51	15.94	15.40	12.85	12.61	12.49	11.43
Billion 1982 dollars											
All industry	352.88	379.74	374.77	365.27	381.52	381.78	390.39	365.87	375.00	375.64	382.56
Manufacturing	142.20	154.78	148.36	147.41	156.24	155.66	159.82	143.34	147.21	147.35	155.56
Durable goods	65.46	71.69	69.92	68.53	72.55	71.33	74.33	65.92	70.09	69.21	74.47
Primary metals	6.95	7.43	NA	7.34	7.16	7.40	7.82	7.46	NA	NA	NA
Blast furnaces	3.44	3.95	NA	3.78	3.78	3.93	4.30	3.71	NA	NA	NA
Nonferrous metals	2.06	1.80	NA	1.92	1.69	1.77	1.81	1.77	NA	NA	NA
Stone, clay, and glass	3.03	3.29	NA	3.10	3.32	3.47	3.25	2.91	NA	NA	NA
Nondurable goods	76.74	83.10	78.44	78.88	83.69	84.33	85.49	77.41	77.12	78.14	81.09
Chemicals	15.34	16.27	NA	16.28	16.72	16.09	15.99	15.73	NA	NA	NA
Nonmanufacturing	210.68	224.95	226.40	217.85	225.27	226.12	230.57	222.53	227.79	228.29	227.00
Mining	19.68	18.18	14.04	17.98	18.90	18.26	17.59	14.65	14.29	14.19	13.02

NA Not available. [r] Revised.

[1] Estimates are based on planned capital expenditures reported by business in late April and May 1986.

Source: U.S. Department of Commerce. News. June 12, 1986, tables 2 and 3.

Table 3

EMPLOYEES ON NONAGRICULTURAL PAYROLLS

(thousands of workers; seasonally adjusted unless noted)

		MANUFACTURING						MINING				
	NON-AGRICULTURAL TOTAL	Total manufacturing	Clay, glass, stone	Primary metals	Iron and steel	Nonferrous[1]	Chemicals, chemical products	Total mining	Total metal mining[1]	Iron ore[1]	Copper ore[1]	Nonmetallic minerals[1]
1982	89,566	18,781	576.9	921.9	336.2	55.5	1,075.1	1,128	72.9	13.2	24.3	109.7
1983	90,200	18,434	570.0	831.8	340.8	49.8	1,042.8	952	56.4	10.3	18.9	104.3
1984	94,496	19.378	592.6	857.4	334.1	51.4	1.049.4	966	55.1	11.4	16.3	108.5
1985	97,614	19,314	590.6	812.8	304.9	45.5	1,045.8	930	46.8	9.8	13.4	110.5
1985:												
Apr	97,104	19,356	590	821	309	46.9	1,052	949	48.5	10.9	13.8	109.8
May	97,338	19,323	590	818	308	46.3	1,048	944	48.1	11.0	13.6	114.5
June	97,442	19,290	589	814	307	45.5	1,046	936	48.0	11.0	13.4	116.4
July	97,672	19,268	589	807	305	45.0	1,045	928	46.4	9.4	13.3	116.8
Aug	97,890	19,256	591	798	302	44.1	1,043	922	46.3	10.5	13.2	116.1
Sept	98,128	19,198	590	795	304	43.9	1,042	917	45.1	9.3	12.8	115.8
Oct	98,428	19,236	591	797	304	43.7	1,040	913	44.6	9.2	13.0	114.6
Nov	98,666	19,259	591	801	302	42.4	1,037	907	45.1	9.6	13.1	112.6
Dec	98,910	19,289	593	803	303	41.8	1,035	901	43.8	8.0	13.5	106.5
1986:												
Jan	99,296	19,303	596	798	300	42.3	1,034	897	44.6	8.8	13.7	100.3
Feb	99,429	19,294	597	795	299	41.7	1,032	880	43.9	8.8	12.9	100.4
Mar	99,484	19,255	594	787	293	41.7	1,031	852	43.9	8.8	13.2	104.2
Apr	99,783	19,245	600	785	291	41.7	1,028	821	43.9	9.7	12.1	110.8
May	99,918	19,201	599	780	288	41.3	1,024	790	43.5	9.7	12.2	113.7
June	99,864	19,145	597	763	287	36.4	1,026	773	42.8	9.5	12.1	114.4
July	100,253	19,122	591	764	284	NA	1,025	769	NA	NA	NA	NA

NA Not available. [1] Not seasonally adjusted.

Source: Bureau of Labor Statistics. Employment and Earnings. Various issues.

Table 4

SELECTED INDEXES OF INDUSTRIAL PRODUCTION

(seasonally adjusted, 1977 - 100.0)

		MANUFACTURING						MINING						
				Primary Metals					Metal Mining					
	TOTAL INDUSTRIAL PRODUCTION	Total	Clay, glass, stone	Total	Iron and steel	Non-ferrous	Chem-icals	Total	Total	Iron ore	Copper ore	Non-metallic minerals	Coal	Oil and gas
1982	103.1	102.2	89.2	65.8	57.5	80.5	103.8	109.3	71.4	66.4	82.6	95.1	119.9	110.9
1983	109.2	110.2	79.1	73.0	66.1	87.9	114.0	102.9	65.2	68.8	75.9	106.1	113.3	102.8
1984	121.8	123.9	112.3	82.4	73.5	99.3	121.7	110.9	77.0	92.1	78.6	116.1	127.6	109.1
1985:	124.5	127.1	114.9	80.6	70.5	99.6	127.1	109.0	74.9	87.7	79.2	118.3	127.5	106.3
Jan	123.6	125.9	112.7	81.7	71.0	102.0	125.7	110.5	70.5	58.6	79.3	118.5	118.5	110.7
Feb	123.7	125.8	110.5	80.2	68.5	102.2	125.8	109.5	74.5	73.2	79.3	119.8	121.5	108.2
Mar	124.0	126.3	111.4	81.8	73.2	98.1	126.5	110.5	83.6	97.0	82.6	118.7	131.9	106.8
Apr	124.1	126.6	114.5	81.4	71.9	99.3	125.8	109.6	81.2	105.8	74.9	118.5	128.5	106.5
May	124.1	126.6	116.3	76.4	65.4	97.2	126.7	109.8	78.3	107.1	76.1	118.7	128.7	106.9
Jun	124.3	126.7	116.1	78.3	67.6	98.5	126.4	110.6	77.5	97.2	73.8	117.9	134.0	106.9
Jul	124.1	126.9	115.1	79.0	68.7	98.5	126.4	108.7	60.9	61.3	92.8	116.6	128.0	106.9
Aug	125.2	128.2	116.2	82.0	71.6	101.6	128.2	108.3	73.1	106.6	76.0	117.7	127.7	105.5
Sep	125.1	127.7	116.2	80.3	69.7	100.4	129.0	108.4	71.4	98.4	74.2	119.3	126.3	106.0
Oct	124.4	127.2	115.6	83.1	74.4	99.5	127.9	108.4	74.2	98.6	77.5	120.4	130.1	104.8
Nov	125.4	128.4	115.2	83.6	75.3	99.3	128.0	106.9	78.3	90.4	79.5	119.0	125.5	103.5
Dec	126.4	129.1	118.2	81.7	72.0	99.8	128.5	107.4	74.3	51.7	90.8	114.0	128.0	104.4
1986:														
Jan	126.7	129.8	120.0	84.9	75.5	102.7	130.5	107.4	75.5	66.1	82.8	117.1	130.6	103 6
Feb	125.6	128.8	118.8	80.7	69.9	101.2	130.9	105.3	77.2	82.0	77.5	120.2	124.9	101.[illegible]
Mar	124.4	128.0	120.0	77.4	64.9	101.1	131.1	102.7	78.1	80.4	80.7	115.2	123.5	98.[illegible]
Apr	125.3	129.0	121.5	78.1	65.6	101.7	132.1	101.5	77.3	94.3	NA	118.9	124.5	96.4
May	124.6	128.7	120.5	75.7	61.7	102.2	132.0	99.8	NA	89.6	NA	116.3	122.4	95.1
Jun	124.2	128.0	121.7	72.5	59.1	97.7	131.7	99.6	NA	NA	NA	117.4	127.0	93.7
Jul	124.1	128.0	NA	73.3	NA	NA	NA	99.2	NA	NA	NA	NA	NA	93.0

NA Not available.

Source: Federal Reserve Statistical Release. G.12.3, Industrial Production. Aug. 15, 1986, tables 1A, 2A, and 4A.

Table 5

CAPACITY UTILIZATION

(percent, seasonally adjusted)

		MANUFACTURING							INDUSTRIAL MATERIALS			
				Primary metals						Metal materials		
	TOTAL INDUSTRY	Total manufac-turing	Clay, glass, stone	Total primary metals	Iron and steel	Non-ferrous	Chemicals, chemical products	MINING	Total industrial materials	Total metal materials	Raw steel	Aluminum
1982	72.1	70.3	65.1	54.2	47.8	65.8	68.5	83.4	71.7	52.8	49.6	65.9
1983	74.7	74.0	72.2	62.0	57.6	69.9	73.4	77.9	75.3	59.4	58.7	67.6
1984	81.2	80.8	80.5	72.5	67.6	80.6	76.8	83.6	82.3	69.2	67.8	83.1
1985:	80.6	80.3	80.4	73.1	68.0	81.1	78.5	81.6	80.3	68.7	66.9	71.7
Jan	81.1	80.7	79.8	73.5	67.6	82.9	78.4	82.9	81.7	68.1	65.9	78.8
Feb	80.9	80.4	78.1	72.1	65.4	83.1	78.4	82.1	81.5	68.2	67.2	76.6
Mar	81.0	80.5	78.6	73.7	69.9	79.8	78.7	82.8	81.4	69.8	68.2	74.2
Apr	80.8	80.5	80.6	73.4	68.8	80.7	78.0	82.1	80.9	69.9	68.4	73.6
May	80.6	80.3	81.7	69.0	62.7	79.1	78.5	82.2	80.1	66.2	67.9	72.9
June	80.5	80.1	81.4	70.8	64.9	80.2	78.2	82.7	80.1	69.0	67.4	72.0
July	80.2	80.1	80.6	71.5	66.1	80.2	78.0	81.2	79.5	66.4	67.2	71.0
Aug	80.7	80.7	81.2	74.5	69.0	82.7	78.9	80.9	79.9	69.4	67.4	70.5
Sep	80.5	80.1	81.0	72.8	67.2	81.7	79.3	81.0	79.5	67.3	67.6	70.3
Oct	79.8	79.6	80.4	75.5	72.0	81.0	78.4	80.9	79.3	69.4	67.4	68.5
Nov	80.3	80.2	79.9	76.0	72.9	80.9	78.4	79.7	79.2	70.8	66.4	66.0
Dec	80.7	80.4	81.9	74.3	69.9	81.3	78.5	80.0	80.1	70.7	61.8	65.7
1986:												
Jan	80.8	80.7	83.1	77.3	73.4	83.6	79.6	80.0	80.2	71.3	71.9	66.0
Feb	79.9	79.8	82.0	73.7	68.2	82.4	79.7	78.4	79.6	68.4	69.8	67.4
Mar	79.0	79.1	82.6	70.8	63.5	82.3	79.7	76.4	78.5	66.4	65.8	68.4
Apr	79.4	79.6	83.5	71.6	64.4	82.9	80.2	75.6	78.6	66.8	69.1	69.5
May	78.8	79.3	82.7	69.5	60.8	83.3	80.0	74.3	78.0	65.5	64.9	69.3
June	78.4	78.7	83.3	66.7	58.5	79.5	79.7	74.1	77.9	64.3	63.3	60.2
July	78.2	78.5	NA	67.6	NA	NA	NA	73.8	77.9	64.2	NA	NA

NA Not available.

Source: Federal Reserve Statistical Release. G.3 (402), Capacity Utilization. Aug. 18, 1986, table 1.

Aluminum Co. of America posted a 31% profit gain from previous-year profits despite a 5-week strike. Another aluminum producer, Reynolds Metals Co., had a 488% increase in earnings to $28.8 million. AMAX, Eagle-Picher Industries, and Phelps Dodge Corp. also reported improved earnings. ASARCO Incorporated and Kaiser Aluminum and Chemical Corp. reported reduced losses when compared with the second quarter of 1985. Hecla Mining Co. and Homestake Mining Co., however, reported reduced earnings because of low silver prices.

Third-Quarter Prognosis

The index of leading indicators, designed to predict economic activities over the subsequent 3 to 6 months, advanced only 0.3% in June after falling a revised 0.1% in May, suggesting continuing slow growth in the third quarter. In June, 6 of the 11 available indicators were positive (change in sensitive materials prices, stock prices, contracts and orders for plant and equipment, money supply, manufacturers' new orders for consumer goods and materials, and building permits), 3 were negative (change in credit outstanding, vendor performance, and average workweek hours), and 2 were unchanged (average weekly initial claims for State unemployment insurance and net business formation). Stronger increases in orders for plant and equipment and manufacturers' new orders for consumer goods and materials are necessary to improve the growth of the economy.

THE OUTLOOK FOR MINING: A VIEW FROM THE STATES[*]

by Allen Born[1]

The theme of these two days, "Industry in Transition," is most appropriate. Economic and societal changes over the past two decades have forever altered the environment in which mining companies operate. These changes have been profoundly felt in the United States but do not affect U.S. companies alone. Mining today is truly an international industry, and anything that touches one part of the industry touches all parts of it. Unfortunately, a great many private sector mining companies were very slow to recognize that their world had changed, and they have been even slower to do something about it.

What are these earth-shaking changes affecting our industry? One such change has been the reduced share of metal intensive goods in the aggregate GNP of industrialized nations. The fast growth in consumer durables is over, and growth in heavy capital expenditures is very slow. Another factor is that while the emerging and less developed nations are not yet significant customers for metal intensive goods, they are emerging as potent low-cost competition. Finally, the increased capacity that is a legacy of the oil company fueled aggressive expansion of the 1970's will continue to haunt us all for some time.

In addition, technological changes and societal development have resulted in the movement of much mineral production as well as steel production, auto manufacture, and other heavy industry away from the United States to the emerging nations. Technological change also has resulted in new goods and processes that, in turn, reduce or substitute for the use of metals in many situations. I am referring to the growth of ceramics and composites as well as new heat treatment processes. For most metals the result has been that consumers are doing more with less. Reduced demand quickly translates to lower prices.

If those are the problems, and the conditions that caused them, what are the answers? Most assuredly there are answers but, before coming to grips with the problems, mining and metal companies everywhere have to rethink their assumptions and shift their strategies. Above all, they must understand that the mining industry is now international.

I see five steps that must be taken if private sector mining companies in the industrialized countries are to be able to meet consumer needs, stay competitive, and prosper.

First, they have to rationalize their operations and accept the fact that in mining the future belongs to the low-cost producer. At my company, AMAX, we believe that so strongly we put that statement on the front cover of our annual report this year. In fact, only the low-cost producer will survive. We have been and are still in a cleansing cycle. This is a long one, probably lasting through 1990. While all of us are cleaning up our acts, some of us must go down the drain. In other words, the high cost operations must shut down permanently. In continuing operations, technological breakthroughs and more productive methods must be applied to reduce manpower needs. Our industry, unfortunately, has not been aggressive enough in embracing new technology to operate mines more efficiently. Dr. George Ansell, president of the Colorado School of Mines, put it well when he said, "The mining industry may have been a leader in the 19th century in mechanization and in developing pumps and diesel engines -- but it has not been a technological leader in the last 50 years." In addition to embracing technology, being a low-cost producer also means trimming staff levels and overhead to the minimum necessary to get the job done.

Second, mining companies should reduce their exposure to extractive operations and increase their roles in downstream products. We have to stop trying to compete head-to-head with low-cost operations controlled by Governments. In short, we must move into value-added products. As an example, I cite AMAX's Specialty Metals business, which adds value to molybdenum and other metals by producing special purpose alloys and shapes, which find markets in an amazing variety of end uses. It's a small operation but one that has been consistently profitable, even when our mining operations were deeply in the red. An even more dramatic example is Alumax, our aluminum business. Alumax is an integrated aluminum company and its fabricated products have been profitable throughout, even when the primary business was in the doldrums.

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[*] Remarks presented at the Canadian Mineral Outlook Conference, Ottawa, Canada, May 29, 1986.

[1] President and Chief Executive Officer, AMAX Inc.

Third, marketing must become much more of an integral activity than it has ever been before. Once upon a time in our business we were largely order takers. To succeed in today's very competitive world requires a much higher degree of creative salesmanship and innovative marketing. We have to get closer to our customers, think the way they think, and find out what they really want. We have to become more market driven and smarter -- making use of commodities markets rather than being driven by them.

Fourth, we must recognize that today's mining industry is not only international in scope but also has constraints on it that were undreamt of a few years ago. I'm not referring only to the increased concern we all have for the environment or the competition from Government owned or subsidized competitors. I am talking about competition for capital with other industries that often offer safer or better returns to investors. I am also talking about the cost of major new mining projects that require companies to take exceptional financial risks in an uncertain investment environment. AMAX's Henderson Mine in Colorado, for example, was completed in 1978 after 10 years of work at a cost of $500 million. Today it would cost well in excess of $1 billion. Few private mining companies can now afford to do a project like that alone. As a result, fewer major projects will be undertaken, and when they are they will be joint ventures with partners from many nations.

Fifth and finally, mining companies must start thinking about themselves differently. We have to remember we are not miners; we are satisfiers of customers' needs. That will enable us to leave the role of commmodities producer largely to less developed countries. Instead we must concentrate on being material and product suppliers. Today's fact is that customers don't care if they use metals, plastics, composites, or glass. They use the material that best suits their need. Superalloys and composites very likely are the wave of the future. Within 5 years, composites may constitute at least 15% of domestic cars, 10% to 25% of airliners, and 30% of high tech home and office equipment. We can move now to be suppliers of these materials, which are natural extensions of our older business, or we can be left behind.

From where I sit, it appears to me that most U.S. mining companies have recognized the steps that must be taken for survival. More than just recognition, we're now seeing action. The necessary changes are being put into place. We will remain tough competitors in the international marketplace.

COPPER'S APPLICATIONS AND MARKETS— NOW AND TOMORROW*

by William H. Dresher[1]

Abstract

Even though it was one of the first metals used by Man, copper did not become significant to the economy until the discovery of electricity and the invention of telecommunications in the latter decades of the 19th century. Today wire and cable account for one-half of all copper consumed.

As with most traditional metals and with the world economy itself, the growth rate of copper consumption has declined over the last 10 years. Slower growth in demand, coupled with excessive supply, has depressed the copper industry. This depression has fostered a growing concern that the demand for copper, and metals in general, will decline in future years. Technological developments, such as optical fiber communications, will reduce the quantity of copper needed for this market, but population growth and new applications will enable copper to retain its prominence in the future.

New applications for copper are likely to be evolutionary rather than revolutionary. Increased consumption is anticipated to take place in electrical and electronic uses, marine uses, and biological uses, and in the tooling used to fabricate some of the new high-performance plastic composite materials.

There is no doubt that copper is a mature metal. It reached its maximum intensity-of-use in the United States more than 60 years ago. Current intensity-of-use data reflect more the offshore manufacturing of copper-containing goods than diminishing consumption.

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* Remarks presented at the Capitol Metals Forum, Washington, DC, Apr. 16, 1986.

[1] President, International Copper Research Association, Inc., New York, NY.

Copper, a Traditional Metal

Although, the use of copper dates back some 8,000 years, copper did not come into its own as a major material until the large scale use of electricity and the telephone in the late 1800's. For example, the world market for copper increased from an average of less than 10,000 mt/yr in the early 1800's to over 100,000 mt/yr in 1870, a growth rate of less than 3%/yr. Once electrification began, the growth rate of copper became explosive, with a doubling in consumption by 1883, and redoublings by 1896 and yet again by 1909 (fig. 1). Since those early days, and until 1980, copper consumption grew 4%/yr to 5%/yr. Following the two world wars, the growth rate returned to the same upward trend. Since 1980, however, many questions have arisen as to what the future holds for copper.

Revolutionary new uses for copper as important as the discovery of electricity are not likely in the near future. However, copper will continue to be an important metal for many decades to come as new applications supplement those existing today. Copper, like other traditional metals, is consumed primarily in capital goods; therefore, its consumption is tied closely to capital projects, particularly those involving electrical power. Yet, in spite of world industrial stagnation in the last 10 years, copper's rate of growth has been positive, and a negative growth rate is unlikely in the foreseeable future.

Nonetheless, new technologies will have decided negative influences on copper consumption, and these influences are already evident in the demand for certain products such as telecommunication cable. Reductions in consumption in copper's traditional markets due to substitution by other materials or to down-sizing will be partly offset by expansion of these markets due to population growth and further development of infrastructure in Third World countries. However, copper must find its place in new applications if its positive growth rate is to extend beyond 1990.

Copper's Traditional Markets

The electrical industry is by far the largest consumer of copper, followed by general engineering and construction, and lastly by the transport industry. This relationship holds for all market regions except Japan, where use by the transport industry exceeds that in the construction industry. This is due to the large number of automobiles manufactured in Japan for export and the relative simplicity and small size of Japanese houses.

Electrical Industry (47.4%)

Wire and cable account for approximately 53% of all copper consumed, and from 72% to 75% of that consumed by the electrical industry. Copper is used in the electrical industry in the form of power cables, telecommunications cables, wiring cables, and winding (magnet) wires.

The only significant wire and cable market in which copper does not play a dominant role is overhead power cables, where aluminum, with about 90% of this market worldwide, predominates. The major advantage of aluminum over copper in this application is its lighter weight, which reduce the number of support towers per unit length compared with those necessary if copper were used. Thus, in this application, the relative cost of the two materials is not as important as is the economy realized in the installed system when aluminum wire is used.

Telecommunications cable is currently the most threatened product of the copper wire market. While optical fibers are viewed as the major competing material, consumption of copper in telephone cables has been and will continue to be influenced negatively by at least five other factors:

1. Use of microwave transmission (including satellite transmission).
2. Use of thinner gauge wire (made possible by the development of low cost solid-state amplifiers).
3. Multiplexing (the sending of several messages or signals simultaneously on the same circuit).
4. Digital systems.
5. Electronic switching.

Collectively, the effect of these new technologies on copper consumption already has been dramatic, and most certainly these technologies together with fiber optics will have a marked impact on the use of copper in telecommunications systems in the future.

Wiring cables, which are by far the largest form of copper wire consumed, include all forms of house wiring, appliance cords and leads, automotive wiring, and marine and aircraft cables. Copper is used in over 90% of all installations for wiring cables. However, economic pressure in many applications has intensified, causing a renewed interest in aluminum. The severity of this threat to copper will be tempered by past experience with failures at aluminum terminals and connectors, which have resulted in fires causing deaths and property loss.

The main end-use applications for winding or magnet wires are large ac and dc motors and generators, transformers, small motors used in household appliances, machine tools, automotive circuits, and luxury goods (stereos, video recorders, televisions, etc.). While aluminum has penetrated some of these applications, concerns for energy conservation have resulted in reverse substitution in a number of end uses, particularly in the United States, where copper has regained substantial tonnages in motor windings over the last 2 or 3 years. Projections for the future in this market are strong since "factory-of-the-future" concepts now under development will require large numbers of wire-wound variable speed motors as automation is employed to increase productivity in the industrialized countries.

General Engineering (19.4%)

Heat exchangers, including power station condensers, desalination plants, valves, pumps, petrochemical and other process plant equipment, bearings, air conditioners, and refrigeration plant equipment, account for approximately 75% of the consumption of copper in this industry sector. Copper consumption in this sector grew modestly during the 1970's and then diminished along with depressed world economic conditions and the resulting capital investment slowdown of the 1980's. Substitution by titanium and stainless steel has been more severe in the United States than elsewhere. Market loss due to substitution and technological changes should be minimal in this industry sector, but growth of copper consumption will depend upon the resumption of capital expenditure by the manufacturing, processing, and energy industries.

Construction Industry (15.6%)

Copper products used in the construction industry include copper tube for domestic water services, fire protection systems, central heating, gas and oil lines, and plumbers' fittings. Copper tube is the second largest copper product form consumed today and represents 11% of all copper consumed and 54% of that consumed in the construction industry. Plumbers' fittings and brassware are the next largest outlets in this industry. The use of copper for plumbing tubing varies around the world. The United States consumes more copper plumbing tube per capita than any other country, whereas, most of the rest of the world still drinks water from galvanized iron or steel tube. In Japan, copper tube production has grown at an impressive rate of 285% in the last 10 years. However, only about 13% of this tube is for plumbing and heating purposes. Most of it is for the commercial or industrial tube markets. In other countries, on the other hand, one-half to three-quarters of the tube produced is for plumbing purposes.

Plastic tubing has begun to penetrate the plumbing tube market, largely driven by the need to lower the cost of building construction, especially in single occupancy buildings. In the United States, for example, a recent survey of plumbing and heating contractors showed that the penetration of plastics into drainage, waste, and vent tubing is already nearly complete, with copper retaining only 6% to 7% of this market; that plastics now supply one-third of the market in water service from the main to the building and this application is growing; but that plastics supply only 5% to 7% of the market in water distribution systems inside the building.

Transport Industry (9.7%)

The transport industry is the smallest end user of copper in every country except Japan. The industry is divided into automotive, railroad, and marine subcategories, and one other that includes aircraft. The automobile industry accounts for 80% of the copper consumed in this sector, with the railroad and marine industries each accounting for 7% to 8%. In 1980, the average U.S. automobile contained 35 lb of copper, approximately one-third in the radiator and heater, one-third in the wiring harness (usually accounted for in the electrical industry), and one-third in alloys used in the engine and elsewhere. For a number of reasons, this distribution, as well as the total amount of copper used, is changing.

The use of copper in the automobile industry has declined in recent years due to four factors: downsizing and increased engine efficiency (to allow the use of smaller engines and therefore smaller radiators), increased cooling efficiency brought about by higher operating temperatures, and material substitution. Between 1977 and 1983 these factors accounted for a drop of 15.8% of the copper consumed in this industry on a worldwide basis. However, because of increasing electrical loads and increased usage of copper-bearing aluminum alloys, copper usage in U.S.-manufactured automobiles has recently increased and is projected to continue to increase to nearly 50 pounds by 1990, when it will again decrease owing to adoption of multiplexing and fiber optic systems.

The use of aluminum automobile radiators is already well advanced in Western Europe with an estimated 80% penetration in 1985. In the United States, aluminum's penetration is less, approximately 30% in 1985, and less certain to reach major proportions; and in Japan, aluminum has captured only 4% of the automobile radiator market. The use of plastic tanks and thinner gauge copper and brass strip in the remaining copper-brass radiators, however, will cause a reduction in the amount of copper used per vehicle even if aluminum does not become the material of choice.

While the automobile industry is expected to continue to use copper in wiring harnesses, and in fact, consumption per car is currently increasing owing to the increasing use of electronic components, the amount required per vehicle is expected to diminish when the industry begins to adopt microprocessors and multiplexed systems toward the end of the decade. Except for luxury cars, where fiber optics may be used, copper is likely to remain the material of choice, but in decreasing quantities after 1990 or so.

Domestic and Miscellaneous Uses (7.9%)

Copper is also consumed in a wide range of end uses such as domestic appliances and household goods that individually are relatively small but collectively total significant tonnage. Although this market is nearly saturated in the developed countries, the market for replacement goods is large and the market in developing countries is growing.

Threats to Copper's Markets

While nobody's crystal ball is sufficiently clear to accurately predict the future (in 1970 few predicted the state of the copper market today), it is worthwile to discuss some of the factors already apparent that might influence copper's future:

1. The invention of the semiconductor and the subsequent development of microelectronics have made possible much of the substitution and miniaturization in wire and cable applications of copper. Fiber optic telecommunication systems, for example, would not be possible without solid-state electronics.

2. The increase in copper mine production, semifabrication, and manufacturing in areas of the world where labor costs are low has had a traumatic effect on producers in the industrialized countries. However, the increase in copper production will aid in the industrialization of the Third World and hence increase copper consumption in these countries.

3. Since copper's major substitutes, aluminum and plastics, also are experiencing supply surpluses, the competition among these rival commodities for the same markets will increase.

4. The copper industry of both Western Europe and the United States has all but abandoned its research and development activities over the last few years at a time when competing material producers have increased theirs. This will have a profound long-term negative influence on the future of copper.

The Search for New Applications of Copper

The International Copper Research Association conducted a survey of the societal changes that might influence the future market for copper. In addition to the influence of social changes on copper consumption, 83 technologies were identified that are likely to impact on copper usage in the future. While the institutional and technological changes that will have a negative influence on copper are all too obvious, those with a potentially positive influence are more difficult to foresee.

As might be expected, new uses for copper will most likely be similar to old uses inasmuch as the utility of copper, like that of any other material, is based on the metal's fundamental properties--electrical and thermal conductivity, ductility, ability to form a wide variety of alloys, and resistance to corrosion. Thus, electrical and electronic uses of copper will continue to dominate copper's markets, and copper demand will follow the same pattern as growth in electric power consumption and investment. Another area of future importance is in marine applications, where copper's resistance to corrosion combined with its resistance to biofouling make it an excellent material in a number of growing applications.

New Electrical and Electronic Uses

While solid-state electronics are tending to diminish the requirement for copper in signal processing systems, they are expected to increase its requirement in power handling systems. Power electronics uses solid-state devices to handle large blocks of power for two major purposes:

1. The direct conversion of electric power from ac to dc and vice versa, or from one ac frequency to another.

2. The control of turbine generators, adjustable-speed motor drives, and in-home appliances such as stoves, washing machines, and dryers. Copper is required for both heat sinks and current conductors.

The need to increase productivity in the manufacturing industry is leading to greater automation on the factory floor. Electronically controlled motors such as the adjustable-speed drive (ASD), as used in automated machine tools, robots, in-plant transport vehicles, etc., will require increasing amounts of winding (magnet) wire as well as hook-up wire and distribution wire. The Electric Power Research Institute (EPRI) estimates that ASD's consumed 21 billion kW·h in 1980 and will consume about 387 billion kW·h by 2000--an 18-fold growth in 15 years.

Power supplies for lasers also should increase the market for copper. The industrial use of lasers has been growing at a rate of 22%/yr, and medical use has been growing 50%/yr. New space and defense technologies could place a large demand on copper for laser power supplies.

Superconductivity technology is now in its infancy. Superconducting devices utilize a superconducting alloy, such as columbium-tin, in a matrix of copper. The copper, because it conducts both electric power and heat, stabilizes periodic disturbances that occur in superconductors. Medical diagnostic imaging systems are already bringing superconductivity to a practical commercial system. Other applications anticipated to be growing in importance are magnets for levitated transport systems, automatic current-limiting devices on power distribution systems, energy storage systems, and further into the future, magnets for fusion power.

While not strictly an electrical application, heat pumps already provide a growing market for copper both in compressor motors and in heat transfer fluid tubing. About 25% of all new single family houses built in 1981 were equipped with heat pumps. EPRI projects that by 1990, 34% of new homes will be equipped with heat pumps and the new-retrofit ratio will be 2:1.

Marine Applications

While copper and copper alloys are not new to the marine uses (copper-sheathed sailing ships and manganese bronze propellers), this is a relatively undeveloped application for copper and in particular, its engineering alloys. Marine industry consumption of copper alloys is about 100,000 mt/yr; the largest applications are in propellers and condenser tubes. Major new markets have appeared in the last 10 to 20 years in the offshore oil and gas industries and the water desalination industry. New marine applications under development by the copper industry, using a 90% copper-10% nickel alloy, include--

1. The sheathing or cladding of the hulls of large ocean-going vessels. This will prevent fouling and reduce fuel costs, permit higher speeds, and minimize periodic bottom maintenence time.

2. The sheathing or cladding of the legs and risers of offshore oil- and gas-producing structures in order to reduce corrosion and drag due to biofouling.

3. As mesh, for the cages used in the ocean farming of finfish and shellfish.

4. As woven wire, in cooling water intake screens for coastal powerplants.

Special Agricultural and Construction Uses

Perhaps the most underused properties of copper are those associated with biological applications. The biocidal properties of copper and copper's role in the physiology and metabolism of humans, animals, and agricultural crops have not been fully exploited. In addition to its use as an algicide in farm ponds and in antifouling paints, copper compounds are used as fungicides and bactericides for a number of crops, particularly in tropical regions. Current agricultural applications are limited to use as a nutrient in copper-deficient soils and for its "tonic" effect on plant growth in some fertilizers.

Recent tests have shown that copper and copper alloys are capable of killing dangerous bacteria. Exploitation of this property may lead to increasing application in the construction industry, particularly as it relates to public health. For example, the waters passing through copper plumbing systems are purified of a number of pathogens. In a recent British Public Health Laboratory Service study of legionella bacteria in the hot and cold water systems of 104 hotels in the United Kingdom, 55 institutions were found to have legionella species in their water systems. Only those systems plumbed in copper were found to be totally free of legionella. Tests sponsored by INCRA show that a number of pathogenic species normally present even in treated water are either substantially reduced or eliminated as a result of their exposure to copper plumbing.

Hospitals have found that the old brass doorknobs are far more sanitary (fewer bacteria on surfaces) than the newer stainless steel knobs. A stainless steel doorknob would have to be sterilized every 15 minutes to achieve the same degree of sanitation inherent in a brass doorknob. These findings are giving rise to a wide variety of possible new applications for copper in public schools, hospitals, public transportation terminals, and other high public use areas.

Cast-to-Size Bronze Tooling

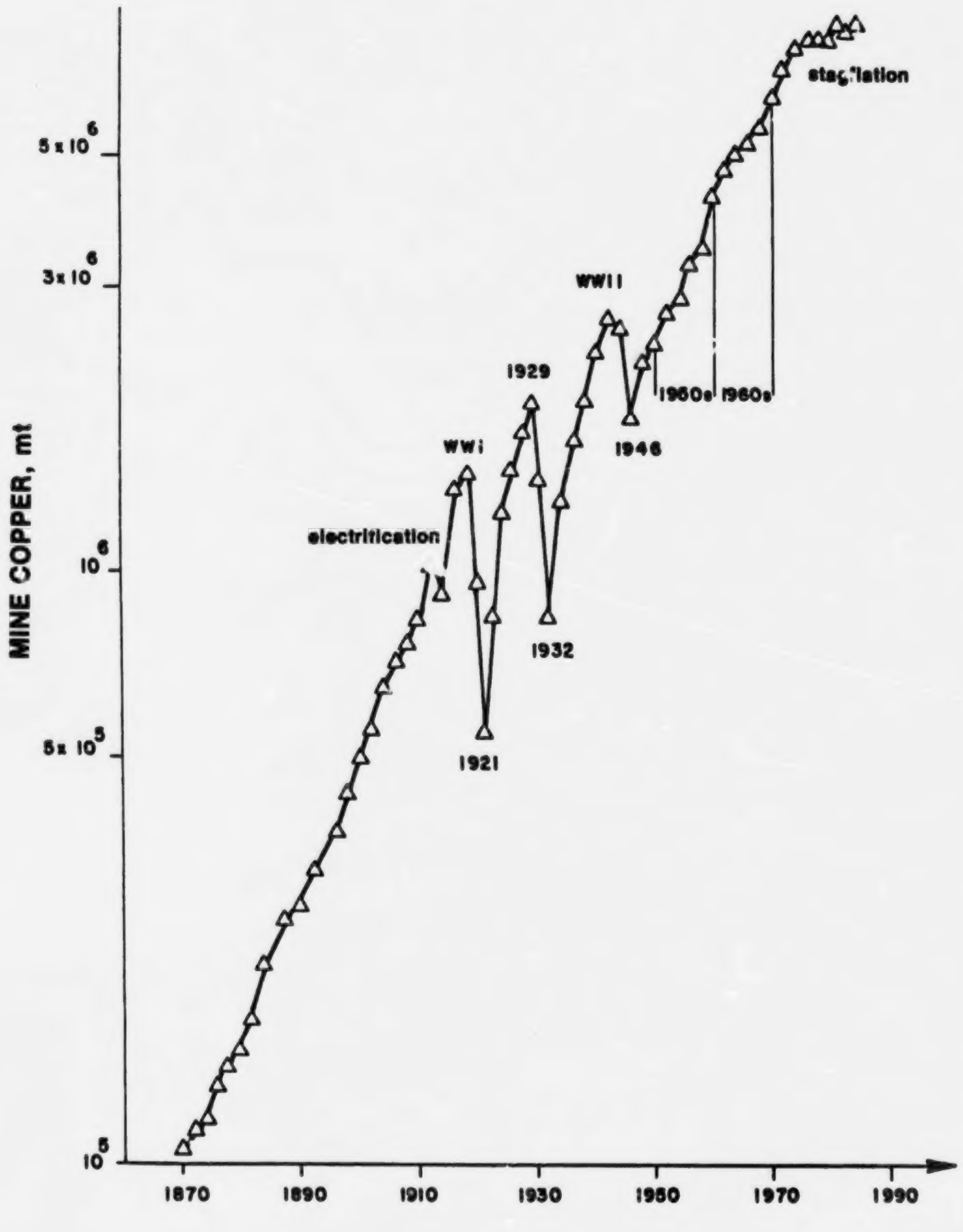
Copper alloys have traditionally been the material of choice for precision castings for works of art, musical instruments, or industrial hardware. A new application for copper, in the form of nickel aluminum bronze, is in the tooling required for the fabrication of advanced composite structures used by the aerospace industry and in reinforced plastic body panels for the automobile industry. The castability of the bronze, combined with its low coefficient of thermal expansion and toughness, makes it an ideal tool material.

The Intensity-of-Use of Copper

It is often said that the intensity-of-use of metals is declining and that dependency on metals is being reduced by use of more advanced materials, and new technologies are reducing the need for copper and other metals in many sectors of the marketplace. However, this is not a new phenomenon. The intensity-of-use of copper in the United States has been decreasing since about 1930 (figure 2). In fact, from 1945 to 1965, when the industry was enjoying its greatest prosperity, intensity-of-use of copper was falling at a faster rate than it is now--a time when the domestic industry is struggling.

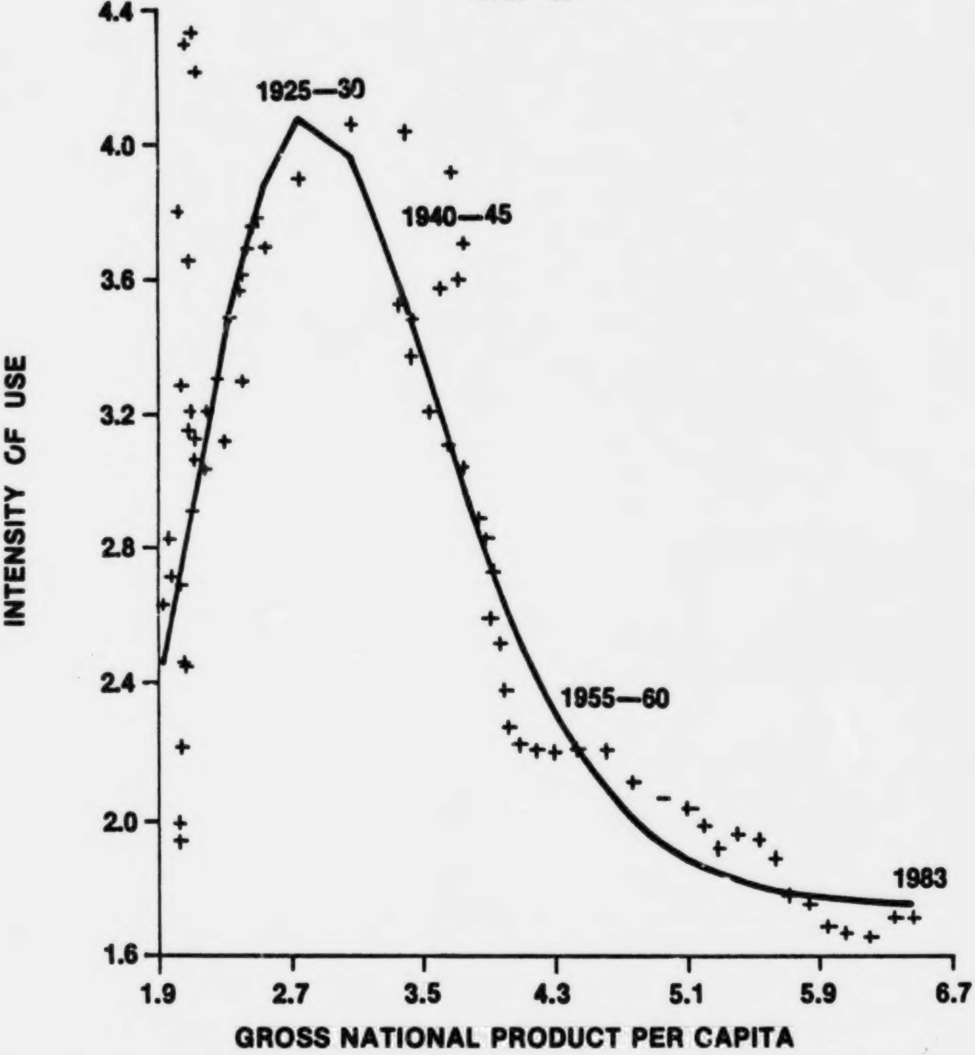
Intensity-of-use is calculated in terms of the amount of raw material--e.g., copper in the form of blister, cathodes, wire bar, and scrap--consumed by a society. Thus, the intensity-of-use for the United States does not include the copper consumed in the form of imported manufactured, fabricated, or semifabricated goods. As might be expected, the intensity-of-use of copper in Japan is higher than that of either the United States or Western Europe--because that is where many copper-containing goods are manufac-

Figure 1
WORLD COPPER PRODUCTION GROWTH



Source: Sutulov, Alexander. Copper at Crossroads. Intermiet Publication, Santiago, Chile, 1985.

Figure 2
LOGNORMAL MODEL OF U.S. INTENSITY OF USE
1907-83



Source: International Copper Research Association, Inc., 1983.

tured. Partly because goods containing metals are being imported more and more frequently from other countries, the service sector of the economy is increasing relative to the manufacturing sector.

Conclusion

Copper is a traditional metal, and in spite of its present economic doldrums, which are largely due to oversupply, it is a vital metal to any industrial society. The percentage distribution of copper use in various markets in 2006 may be similar to the distribution seen today. New uses for copper will fit into the existing categories in about the same proportion as uses now being displaced. Copper will continue as a traditional metal. Copper's growth rate, in all probability, will not return to the 4%/yr to 5%/yr levels of the post-World War II era. However, its use will continue to grow as technology brings about new opportunities for copper uses and new applications supplement the old.

ALUMINUM—THE PAST 35 YEARS OF PRODUCTION AND CONSUMPTION

by Richard K. Schaefer[1]

Over the last several decades, substantial changes have occurred in the production and use of aluminum. One change of particular interest has been the growth and maturity of the domestic aluminum industry. Between 1950 and the mid-1970's consumption of aluminum increased at a fairly steady rate. Since then there has been a leveling off, followed by a slight decline in consumption. These changes are typical of industrial growth and maturity patterns, which tend to consist of the following phases: (1) rapidly accelerating growth; (2) a change to sustained, constant growth; (3) a gradual slowing of growth rates; and eventually (4) zero or negative growth. Since aluminum is a relatively recently produced commodity, signs of maturity are just beginning to appear.

Analysis of the various economic sectors that consume aluminum reveals some of the underlying economic reasons for these changes. Until about 1973 each economic sector that consumed aluminum increased consumption. Since then consumption has increased only in the containers and packaging sector, while the other sectors have leveled off or declined. The following observations on aluminum use in packaging and containers are of particular interest: (1) aluminum has captured about 94% of beverage container sales; (2) over the past 10 years, a 20% to 30% reduction in can weight has been obtained; and (3) the rate of can recycling (i.e., use of scrap) is fairly high. The last two factors have had the effect of making and keeping aluminum prices competitive in this sector. Given the large current share of aluminum in the container market and the recent competition from plastics, the prospects for future growth for aluminum in this market are limited, and some decline is likely.

In building and construction, price competition has had a measurable effect on aluminum consumption. Until 1974 aluminum prices were competitive with those of certain construction materials. Since then, because of increased energy costs and other factors, real aluminum prices have increased sufficiently to allow competitive products to capture part of aluminum's market share.

The quantity of aluminum used in other sectors (transportation, consumer durables, machinery and equipment, and electrical) has changed relatively little since the mid-1970's. It would appear that the physical performance of aluminum, within broad price limits, is of paramount consideration in material selection. The trend of aluminum consumption for the last 5 to 10 years has been similar to that of the durable goods production index and will likely remain similar for the near future.

As aluminum consumption has leveled off, so has domestic production. The decline in U.S. smelter capacity is one indication that aluminum producers have responded to new demand patterns. Smelter closings also indicate a realization by producers that their competitive position in the world aluminum market is not promising, especially since excess U.S. capacity has not been used to reduce or eliminate the average 5% of consumption that has been traditionally met by imports. Although domestic aluminum productive capacity relative to capacity in the rest of the world has decreased from 36.5% in 1950 to 26.5% in 1985, imports relative to total consumption have changed little, if at all.

Other developed nations, primarily the European Economic Community and Japan, have experienced declines in relative production capacity. Current trends indicate that demand growth in most developed countries has leveled off, with general economic conditions accounting for year-to-year fluctuations. Some developed countries such as Canada and Norway, with relatively low-cost energy supplies, have increased capacity and exports to other developed countries and probably will continue to do so. (For example, about one-half of U.S. imports of aluminum now originate in Canada.) As the economies of developing countries expand, the countries often attempt to develop domestic aluminum capacity. In some instances countries have developed capacity in order to generate foreign exchange, often resulting in excess aluminum supplies.

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[1] Economist, Bureau of Mines, Washington, DC.

Because competitive materials are expected to continue to make inroads into current aluminum markets, domestic producers have reduced capacity. To stem the erosion of demand, some aluminum producers are expanding or diversifying their research and development efforts into advanced materials, such as ceramics, composites and laminates, and polymers, and toward advanced manufacturing systems. These product and manufacturing areas are at a stage of development comparable to that of the aluminum industry 10 to 20 years ago. Thus, expertise in such areas as food containers, alloys, and engineered materials is being transferred to new business opportunities for the dynamic aluminum producer. These efforts, together with aggressive marketing programs, should enable producers to maintain, if not expand, revenues.

The following sections indicate these changes through graphs, brief historical explanations, and analysis dealing with such topics as consumption, production, and trade, both domestic and international. Data and information used for the text were obtained from Bureau of Mines publications and commodity specialists.[2] The graphs are based on data from issues of the Minerals Yearbook dating back to 1950 and issues of Mineral Facts and Problems dating back to 1956.[3]

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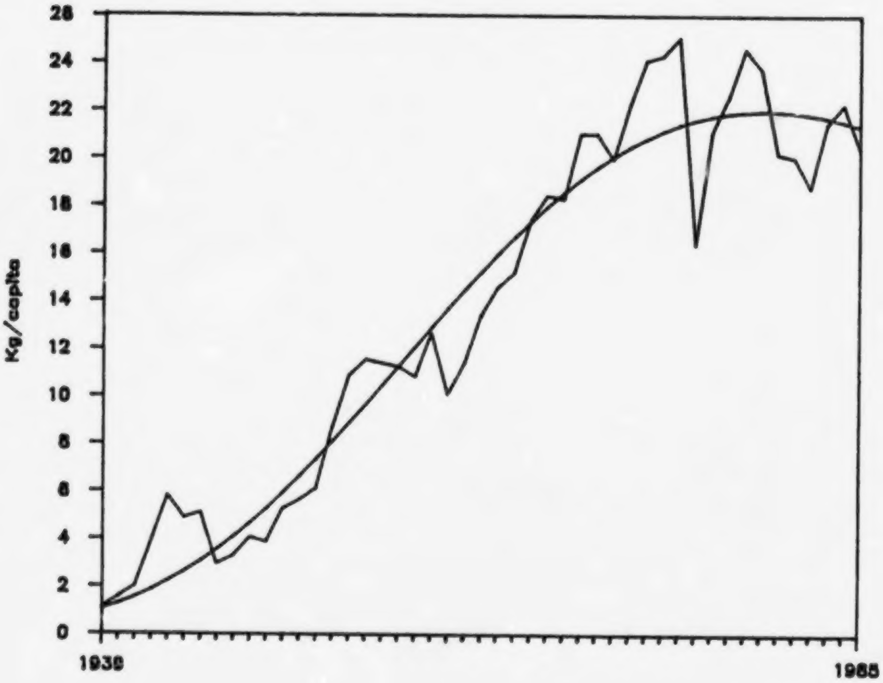
[2] Luke Baumgardner, Frank X. McCawley, and John W. Stamper, Bureau of Mines.

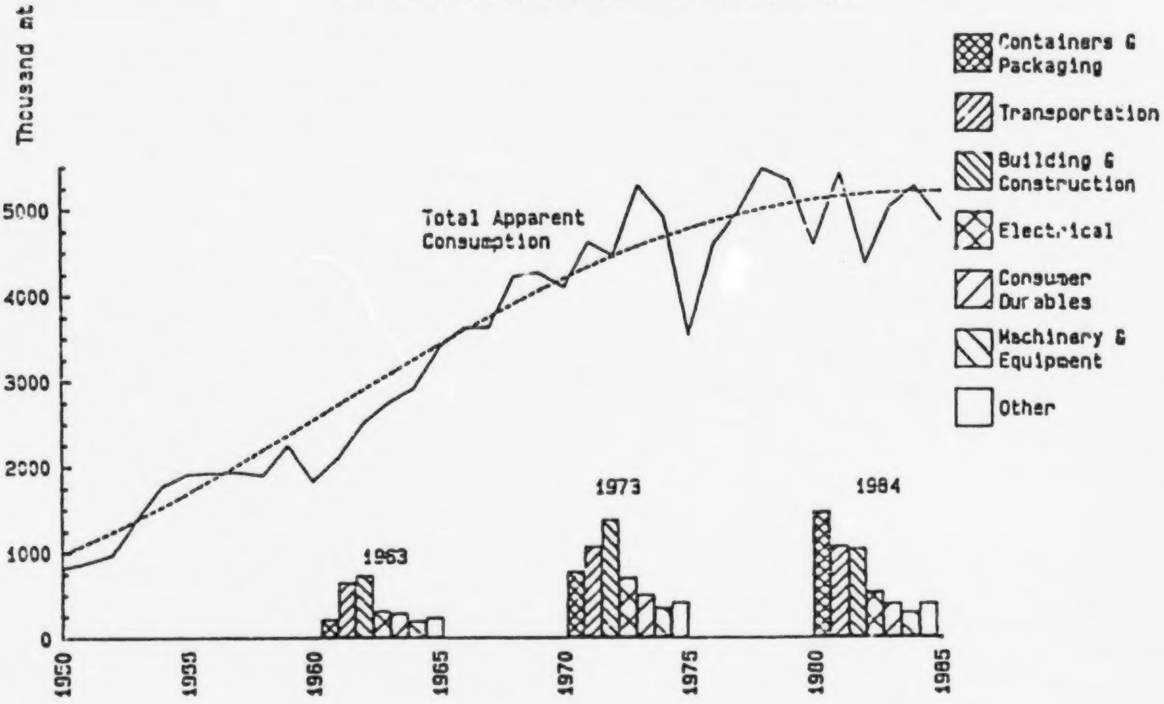
[3] Data collection was performed by Hugh Galagher, Bureau of Mines.

GROWTH IN PER CAPITA ALUMINUM CONSUMPTION IN THE UNITED STATES SLOWED IN THE LAST 15 YEARS AFTER TWO DECADES OF RAPID GROWTH



- Consumption of aluminum has followed a long-term growth curve similar to that of other metals.
- Consumption increased sharply during the 1950's and 1960's as specific properties of aluminum were used to advantage when substituting aluminum for other materials.
- During the 1980's and 1990's decreases in per capita consumption are expected as new materials such as plastics and ceramics compete with aluminum for the same markets and as new technology leads to conservation in materials use. New markets, however, could increase per capita demand for aluminum.

GROWTH IN TOTAL U. S. ALUMINUM CONSUMPTION HAS OCCURRED IN ALL ECONOMIC SECTORS SINCE 1960



- The greatest growth occurred in the "containers and packaging" sector, where aluminum now accounts for 90% of the beverage can market. Current aluminum consumption in this sector alone exceeds total consumption for 1960.

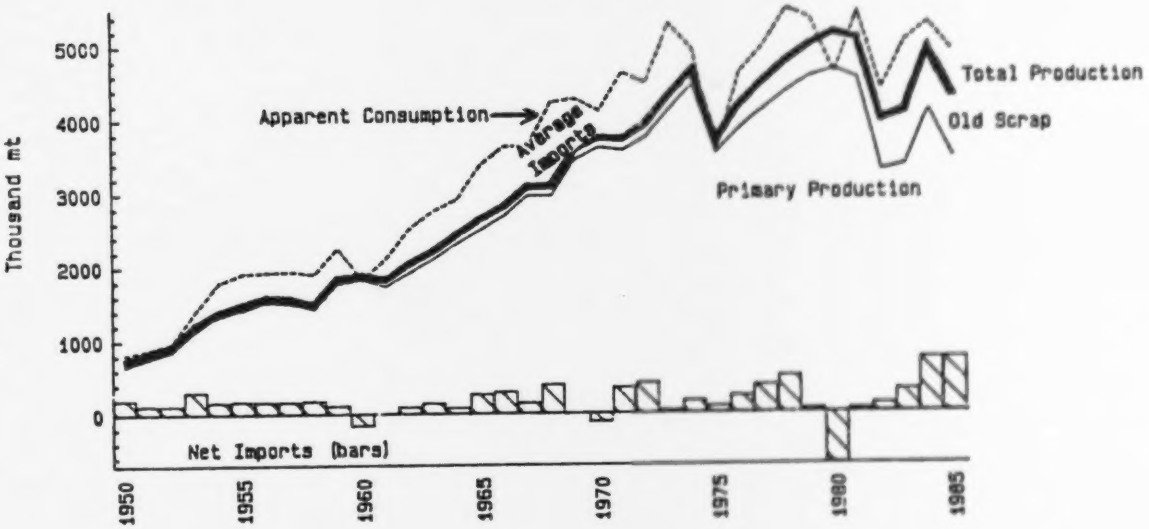
- Higher aluminum prices, attributable in part to increased energy costs and to a depressed construction industry, resulted in a significant decline in the use of aluminum for building and construction between 1973 and 1984.

- Domestically produced aluminum consumed by the transportation sector increased until 1980, when the increasing strength of the dollar encouraged imports of finished products containing aluminum, such as automobiles.

- Since 1973 there has been little change in aluminum consumption in the "consumer durables," "machinery and equipment," and "other" sectors.

- Electrical sector aluminum consumption has declined more than 20% since 1973, primarily because of fewer electrical power developments, such as plant construction and power line installation.

U.S. PRODUCTION HAS KEPT PACE WITH THE FIVEFOLD INCREASE IN CONSUMPTION OVER THE LAST 35 YEARS. ON AVERAGE ONLY 5% OF U.S. CONSUMPTION HAS COME FROM IMPORTS.



Note: Net imports includes metals and alloys crude; plates, sheets, bars etc.; and scrap.

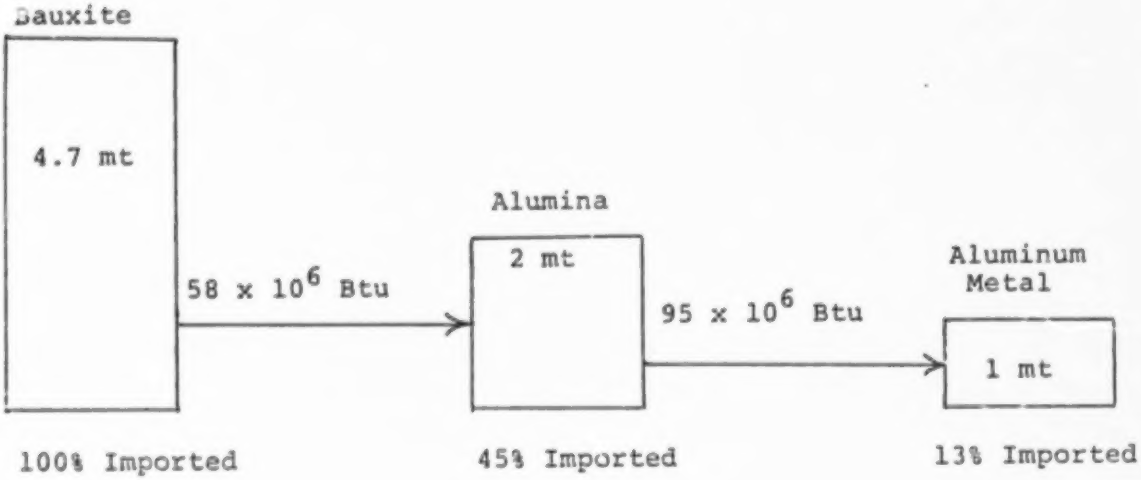
- In most years, U.S. aluminum consumption exceeded domestic production. The difference was met by imports, most of which came from Canada.

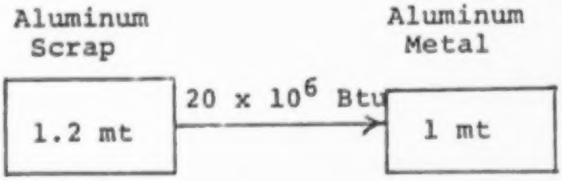
- Since the energy crisis of 1973, net imports of crude and semifabricated metal have more than doubled. During the same time period net exports of scrap also have doubled.

- Primary production--new metal produced from alumina--plus recovery from old scrap (e.g., beverage cans) equals total production.

- The increase in energy costs during the 1970's, higher aluminum prices, and environmental problems caused by the disposal of beverage cans resulted in an increase in the recovery of metal from scrap. The program of collecting and recycling used aluminum beverage cans was a major factor in the increased use of scrap.

BAUXITE AND ALUMINA ARE THE MAJOR RAW MATERIALS FOR THE ENERGY-INTENSIVE PROCESS OF PRODUCING ALUMINUM METAL


Bauxite
4.7 mt
58 x 10⁶ Btu
Alumina
2 mt
95 x 10⁶ Btu
Aluminum Metal
1 mt
100% Imported
45% Imported
13% Imported


Aluminum Scrap
1.2 mt
20 x 10⁶ Btu
Aluminum Metal
1 mt

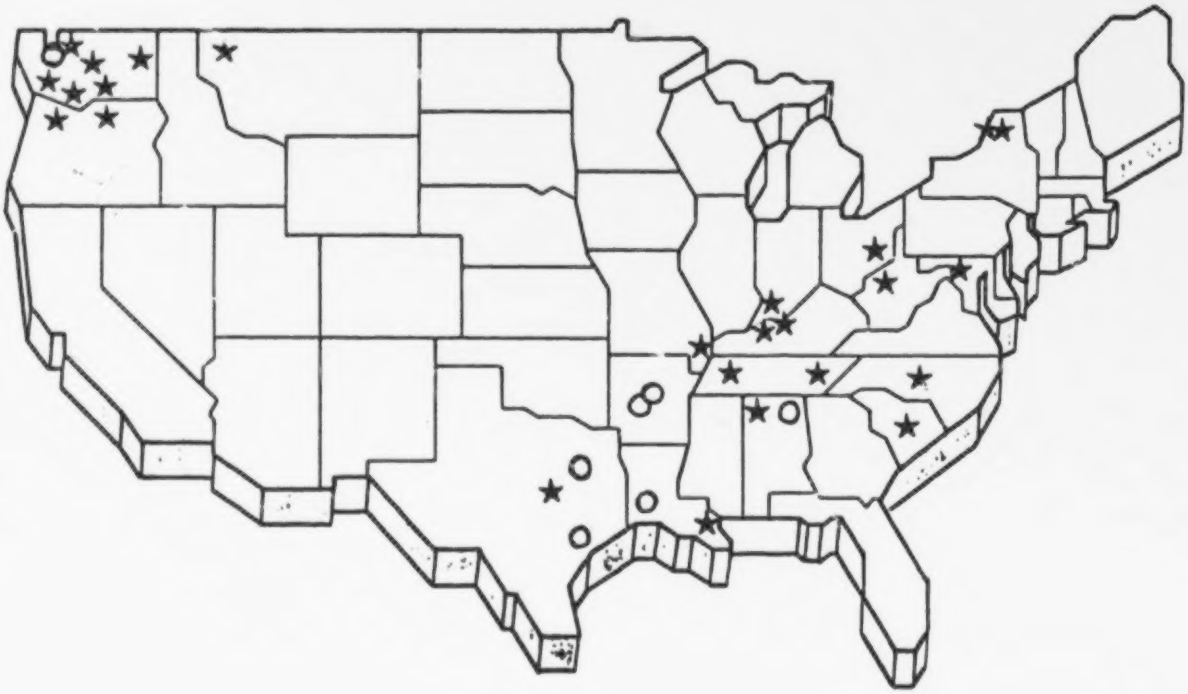
- The production of aluminum is highly energy intensive. Approximately 150×10^6 Btu are needed to produce 1 mt of aluminum from bauxite. Only 24×10^6 Btu are needed to produce 1 mt of steel (BOF process).

- The most energy intensive step is the conversion of alumina to aluminum, which requires 7.5 kW.h of electrical energy to produce 1 lb of metal.

- The conversion of old scrap to usable metal requires only about 15% of the energy needed for producing aluminum from bauxite.

- Because of rising energy costs over the last 10 years, continued or new U.S. production probably will be located near lower cost electrical energy sources.

ALUMINUM SMELTERS ARE DEPENDENT UPON LOW-COST POWER AND BULK TRANSPORTATION FACILITIES



★ Operating June 1986.

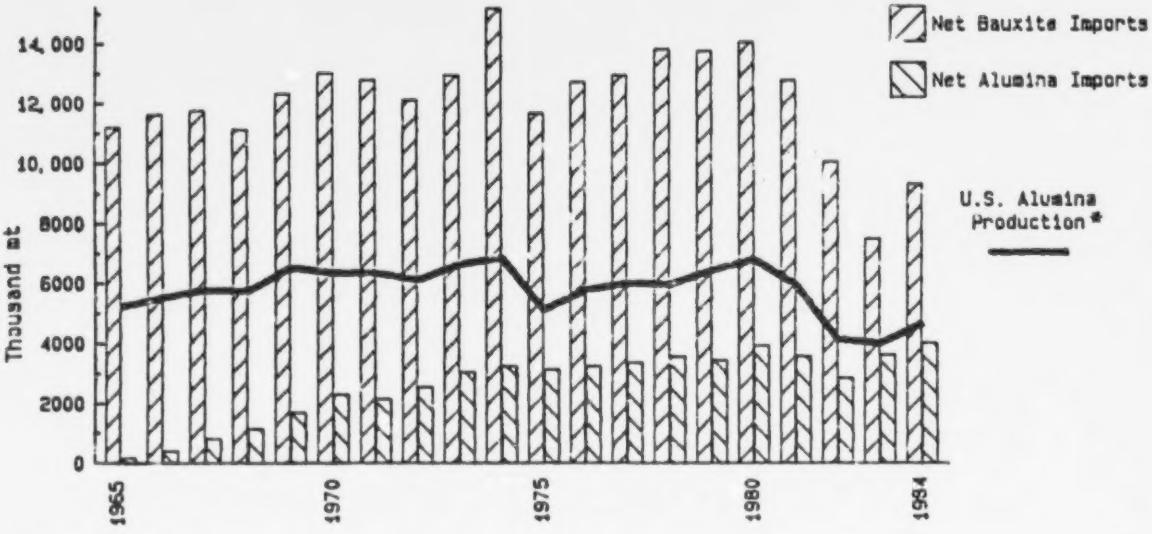
O Closed between 1981 and 1986.

— The United States smelter annual capacity grew from
1950 - 700,000 mt
1960 - 2.2 million mt
1970 - 3.8 million mt
1980 - almost 5 million mt
but recently capacity declined sharply to about 4.5 million mt by 1986.

— From 1950 to 1970 the capacity utilization rates were usually high — more than 80%. In recent years the rates have dropped despite closing of plants. The 1985 rate averaged 65% of 4.9 million mt of annual capacity.

— Plants that have recently closed are generally those that have been less efficient and that had higher energy costs.

EVEN THOUGH THE UNITED STATES IS NEARLY SELF-SUFFICIENT IN ALUMINUM METAL PRODUCTION, IT IS TOTALLY DEPENDENT ON IMPORTS OF BAUXITE AND ABOUT 50% DEPENDENT ON IMPORTS OF ALUMINA.



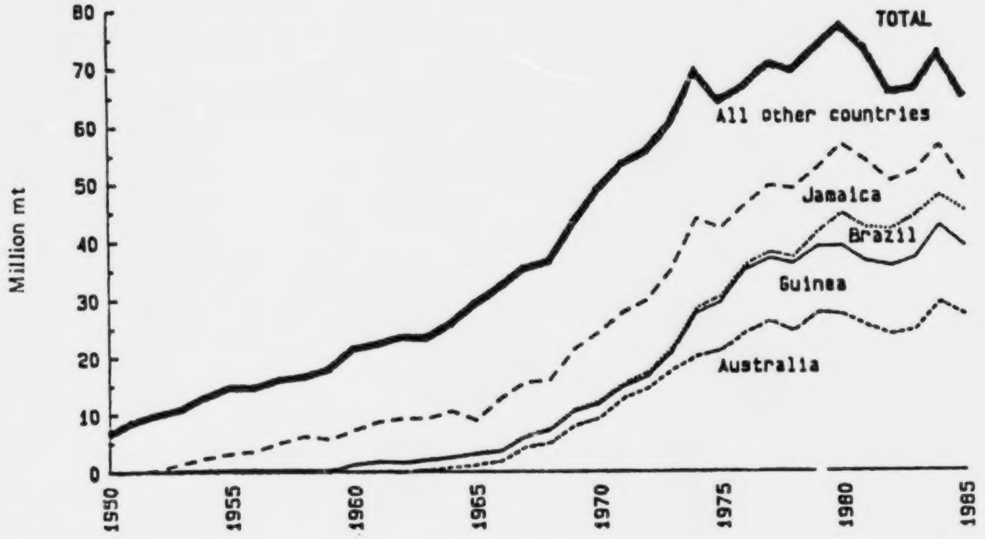
Note: Gross weights

— High-quality bauxite reserves in the United States are nearing depletion and are used for nonmetal applications only.

— The United States is importing less bauxite and more alumina as offshore suppliers seek to reduce transportation costs, process bauxite locally, and export a higher valued commodity.

* 2.3 lb of bauxite are needed to produce 1 lb of alumina.

MOST BAUXITE IS PRODUCED IN THE WESTERN HEMISPHERE AND AUSTRALIA, ENSURING A STABLE U.S. SUPPLY



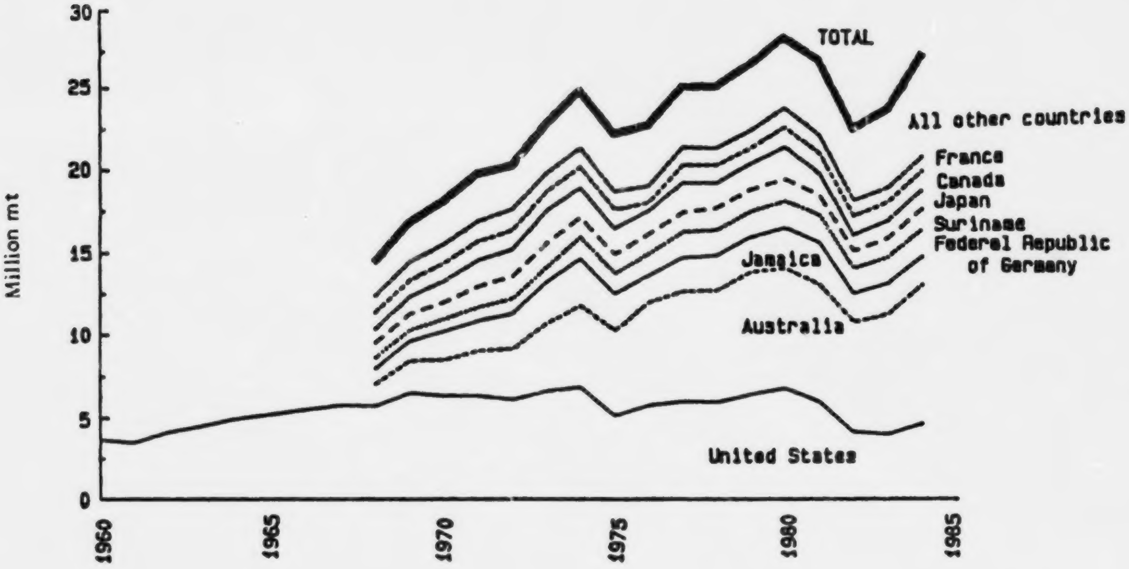
Note: Excludes centrally planned economy countries.

— Guinea has quadrupled its production since 1970 and is now the largest source of bauxite for the United States (47% in 1985).

— In the last 20 years Australia's share of world bauxite production increased from less than 1% to more than 33%; in 1985, the United States imported about 10% of its bauxite from Australia.

— The sources of bauxite supply are diverse. Production in 17 "other" countries, including the United States, totaled 20% of world production in 1985.

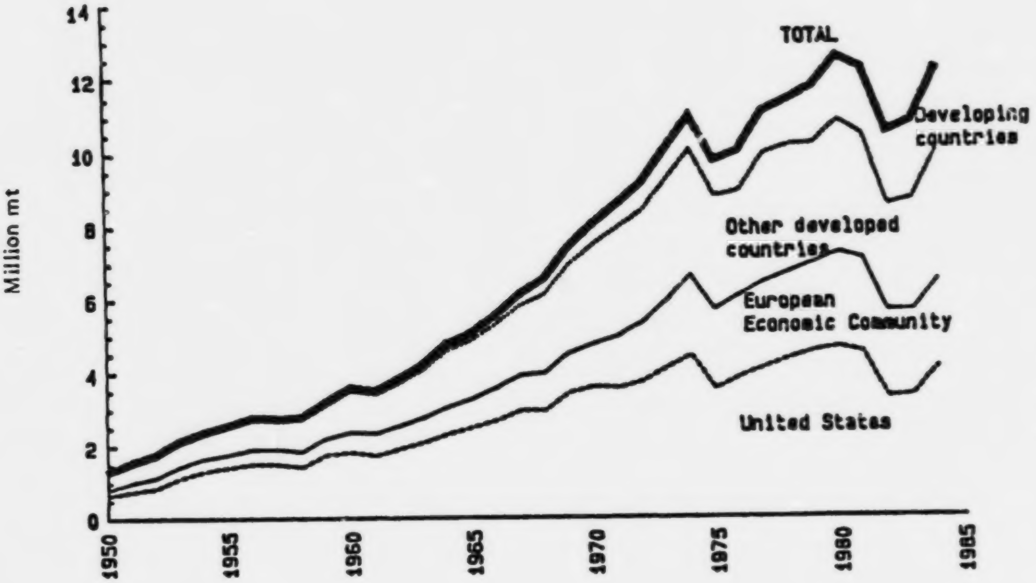
THE UNITED STATES IS THE WORLD'S SECOND LARGEST PRODUCER OF ALUMINA, PROVIDING MORE THAN 50% OF THE RAW MATERIAL TO U.S. SMELTERS



Note: Excludes centrally planned economy countries.
U.S. data only 1960–67

- The United States was the world's largest producer of alumina until 1975, when it was surpassed by Australia.
- Australia accounts for most of the increase in world alumina production over the last 15 years and supplies 68% of U.S. alumina imports.
- Except for Japan, which has decreased its production of alumina, most of the major producers have kept their production at about the same level over the last 15 years.
- The 12 "other" producers more than doubled their share of world production between 1973 and 1985.
- The widespread production of alumina tends to insure secure supplies of alumina at competitive prices.

THE UNITED STATES CONTINUES TO BE THE WORLD'S LARGEST PRODUCER OF ALUMINUM.



Note: Excludes centrally planned economy countries.

- — Most aluminum is produced in developed countries, largely for domestic consumption.
- — Countries with relatively low-cost electric power (such as Canada, Australia, Venezuela, and Brazil) have increased or developed new production capacity since 1974.
- -- Japan's production of aluminum has decreased by about 75% since 1977, mainly because of increased electric energy costs.
- — The United States will continue to lose its domestic market share to foreign producers if disparities between U.S. and international energy costs grow larger.

INTERNATIONAL ISSUES AND ACTIONS

CHINA

Foreign Cooperation Coordination Commission Established: China's State Economic Commission has established a Foreign Cooperation Coordination Commission to help resolve the problems encountered by joint ventures between foreign and Chinese partners. Foreign organizations have invested $6 billion in 2,300 joint ventures, with U.S. companies providing $1.4 billion of this amount. Foreign partners, however, are seeking an improvement in investment conditions, operating autonomy, use of personnel, management coordination, and foreign exchange payments. Mineral-related projects opened to foreign investment include construction of a 600,000-mt/yr cement plant, a 100,000-mt/yr quartz quarry, and a 30,000-mt/yr titania plant.

Metallurgical Exposition in Beijing: The Ministry of Metallurgical Industry (iron and steel) and China National Nonferrous Metals Industry Corp. (all ferroalloying ingredients and nonferrous metals) cosponsored a metallurgical industry exposition in Beijing on June 24-30, 1986. The exposition covered a wide range of subjects, including equipment, instrumentation, automation systems, environmental controls, ore dressing techniques, and production technology for the ferrous and nonferrous sectors. Numerous private industrial firms throughout the world including some from the United States participated in the exposition. During 1986-90, China is expected to spend more than $1 billion to upgrade and expand its metallurgical industries.

COLUMBIUM AND TANTALUM

Fire Destroys Processing Plant in Thailand: A fire on June 23, 1986, at the new columbium and tantalum processing plant on Phuket Island, Thailand, reportedly destroyed some 70% of the facility. The fire occurred after protestors demonstrated against the opening of the chemical plant because of environmental concerns over the plant's waste treatment facilities and acid storage areas. The facility, Asia's first, is owned by the Thailand Tantalum Industry Corp. (TTIC). Reports indicate that the plant's initial capacity was planned to be in excess of 300 mt/yr each of columbium and tantalum pentoxides and over 500 mt/yr of potassium tantalum fluoride. This plant would have represented a shift in the location of processing facilities to Thailand from Europe or the United States rather than an increase in world production. A 3-month feasibility study on the relocation of the plant is planned, but local opposition is a continuing concern. Columbium and tantalum supply would not be affected if the TTIC project is not revived, because adequate world processing capacity already exists. The TTIC facility was financed by the World Bank. Thai officials are concerned that the destruction of the plant could affect financing of other World Bank projects in the country.

COPPER

United States Requests Meeting on International Copper Producer-Consumer Forum: In line with a decision of the Interagency Copper Working Group, the United States has requested a meeting in Geneva this fall of the United Nations-supported Ad Hoc Committee on Commodities. This will be the first international meeting to discuss the need for a Producer-Consumer Forum for Copper. A meeting to negotiate the terms and articles for such a forum would be held next spring if the fall meeting is successful.

DIAMONDS

Zaire's 1985 Diamond Production Sets World Record: Despite a world diamond glut, Zaire's diamond production in 1985 exceeded 20 million carats, the highest production level ever recorded by any country. Zaire's diamond sales for 1985 were valued at $186 million. Preliminary data indicate that Zaire will produce about 21.5 million carats in 1986. Although "gem quality" diamonds account for only 4% of Zaire's output, much of its diamond production is of near-gem quality and is sold mainly to diamond cutters in India.

GOLD

Japanese Demand for Gold Jewelry Up: The rising value of the Japanese yen against the U.S. dollar has reduced the yen price of gold and led to a new demand for, and private hoarding of, gold jewelry in Japan. The Nation's imports of nonmonetary gold during the first 4 months of 1986 were 79% greater than for the same period in 1985. Switzerland, the Soviet Union, the Republic of South Africa, and Australia reportedly supplied much of this gold.

Japan To Issue Hirchito Commemorative Coin: Japan's new gold coin commemorating Emperor Hirohito's 60-yr reign is due to be issued in November. The 10 million coins, which will be legal tender, are to be issued at a face value of 100,000 yen, about $650, which is 2.5 times the current value of the gold content. Each coin will contain 20 g of 99.99% gold. Japan has imported gold at a rate of about 60 mt per month since January, with a 6-month total of 348 mt of bullion. If Japanese gold imports continue at the current rate, about half the Western supplies will have been purchased by Japan this year. A large part of the 223 mt of gold earmarked for the coin minting was imported through the United States from various United States, British, and Swiss sources, and has helped to narrow the United States-Japan trade gap. Anticipating oversubscription of the coins, Japan will issue them by lottery on October 16. Up to 100,000 coins will also be made available to foreign purchasers through overseas financial institutions, most likely on a first-come, first-served basis.

United Kingdom Bans Imports of Krugerrands: The United Kingdom has banned imports of South African Krugerrands. The ban, which became effective on May 23, does not prohibit trading of Krugerrands owned by private citizens and travelers. The United States already has a ban in place on the importation of Krugerrands.

NICKEL

U.S.S.R. Expected To Boost Nickel Sales to Market-Economy Countries: Depressed oil prices reportedly are spurring a Soviet effort to boost sales of metals to market-economy countries. The most significant impact will be felt in the nickel market; sales to market-economy countries in 1986 could reach 55,000 st, double the amount sold in 1985. World nickel production in 1985 was 857,000 st. Such shipments by the Soviets would undermine current efforts being made by other major producers to restrict nickel supplies by curtailing production. The Soviet strategy probably will result in continued low nickel prices.

STEEL

Attempt To Restructure Steel Industry Fails in Federal Republic of Germany: The Federal Republic of Germany (FRG), like other member countries of the European Economic Community (EEC), has been attempting to restructure its steel industry for a number of years, but this has proved to be especially difficult in the FRG. The latest attempt to restructure the steel industry through merger and subsequent rationalization was Krupps AG's 1986 attempt to merge its steel section into a new company with Klockner AG and CRA, an Australian mining concern. The merger was defeated by political opposition, lack of public support, and the FRG Government's reluctance to subsidize one-third of the merger costs. Even though the merger has been abandoned, the three partners continue talks on possible future cooperation.

The absence of mergers has induced the companies to concentrate their efforts in specialized fields. Hoesch AG has concentrated on producing coated sheet and Krupp on carbon flat products and stainless steel. Klockner has continued its internal restructuring plans, involving regrouping of its steel division and investing in a new 720,000-mt/yr six-strand continuous bloom caster for its Georgsmarienhutte works, previously earmarked for closure under the merger plans. The caster is due on stream in January 1987. There is also a trend in the FRG to rationalize output by barter of various products. The West German steel industry believes that its technical excellence will keep it ahead of other EEC competitors.

FEDERAL, STATE, AND LOCAL ACTIONS

ENVIRONMENTAL ISSUES

EPA Issues Final Rules on Arsenic Emissions: The Environmental Protection Agency (EPA) has issued its final rules on arsenic emissions from copper smelter and glass manufacturing plants. Only one copper smelter and two glass manufacturing plants will need to install additional air pollution control equipment to comply with the new emission standards. The preliminary regulations, issued in July 1983, required additional emission controls at 6 copper smelters and 14 glass manufacturing plants. The new regulation requires an emissions limit of 11.6 mg of particulate per dry standard cubic meter of exhaust gas and applies the standard for converter secondary emissions to all converters where the average annual arsenic feed rate is 75 kg/h (164 lb/h) or greater. The preliminary regulations proposed a level of 6.5 kg/h (14 lb/h). Tougher arsenic regulations would have forced the closing of plants or would have resulted in costs disproportionate to the gain in health benefits, according to the EPA. Inorganic arsenic emissions have been linked to skin and lung cancer.

New Asbestos Standards Now in Effect: The Occupational Safety and Health Administration (OSHA) adopted a new, lower workplace asbestos exposure standard, effective July 21, of 0.2 fiber/cm^3 averaged over an 8-h work period. The previous exposure standard was 2.0 fibers/cm^3. OSHA estimates that the new standard will reduce the number of asbestos-related cancer deaths from 64 to 6.7 per 1,000 workers and the number of asbestosis cases from 50 to 5 per 1,000 workers. The new regulation requires employers to provide respirators and protective clothing for employees exposed to asbestos concentrations greater than the new limit and to maintain medical records on employee exposure. The new regulation also requires the construction industry to erect plastic barriers when removing asbestos, to filter the air leaving asbestos-filled work areas, and to provide decontamination areas for workers.

Radioactivity Detected in Beef From Cattle Grazing Near Uranium Mines: The New Mexico Environmental Improvement Division has detected higher-than-normal levels of radioactive material in the meat of cattle raised near uranium mines in the Grants Mineral Belt, a 2,500-square-mile area in the northwestern part of the State. Fearing that long-term consumption of the beef of cattle that graze on land contaminated with uranium mill waste and tailings might lead to a higher risk of cancer, State officials have advised residents to avoid using local cattle as their sole source of meat. Officials report that the risk of cancer from consumption of cattle from the studied area is 1 in 280,000, compared with 1 in 1,310,000 from a control group of cattle.

EPA Identifies Additional Superfund Sites in Colorado: The EPA added three Colorado mineral-bearing sites--Smuggler Mountain and the Eagle Mine (lead-silver properties) and the Uravan uranium-vanadium mill--to the nine sites in the State that have already been designated as Superfund cleanup sites, although the Superfund program has not yet been reauthorized by Congress. Funds are needed at the Uravan site to stabilize the plant's older mill tailings piles so that they will comply with recent EPA and Nuclear Regulatory Commission standards issued under the authority of the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604). Similar tailings stabilization projects already have been funded by the U.S. Department of Energy (DOE), and work is in progress at sites in Grand Junction, Naturita, and Old Rifle, CO; Monument Valley and Tuba City, AZ; Shiprock, NM; and South Salt Lake, UT.

Date of Douglas Smelter Shutdown Moved Closer: After weeks of negotiations with EPA and Arizona State officials, Phelps Dodge Corp. has agreed to close its Douglas, AZ, copper smelter by January 15, 1987, a year earlier than scheduled. Regulatory agencies consider the smelter a major source of air pollution in the area. The shutdown agreement requires Phelps Dodge to pay $400,000 for past violations of Federal sulfur dioxide emission standards and provides for additional fines of $100,000 for any future violation. Federal and State officials will close the smelter immediately if more than five violations occur before January 15. The smelter, which shut down on July 10 to avoid violating Federal clean air standards, reopened July 30 with operations sharply reduced.

California Enforces Water Quality Standards: During the last week of June, the California Regional Water Quality Control Board imposed Federal quality standards on six inactive Shasta County, CA, copper mines. The agency adopted waste discharge permits for the mines that for the first time include specific limits on toxic heavy metal discharges. The board required Silver King Mines, Inc. and Sharon Steel Corp. to attain full compliance with the new water quality standards by January 1, 1988. The enforcement action sets stringent water effluent pollutant limits for copper, zinc, cadmium, mercury, lead, and suspended solids.

TRADE ACTIONS

Federal Judge Orders Limit on Uranium Imports: A Federal judge has ordered the DOE to halt enrichment of all foreign uranium by January 1, 1987, and to limit the amount of foreign uranium that it enriches to 25% of the total processed during the previous 6-month period. The suit was brought against DOE by Energy Fuels Nuclear, Inc., Uranium Resources, Inc., and Western Nuclear, Inc., all three of which are members of the Uranium Producers of America (UPA). (See Minerals and Materials, August/September 1985, p. 11.) Attorneys for DOE immediately sought to overturn the ruling, and on July 21 the 10th Circuit Court granted a stay of the injunction; hearings are scheduled for September. If allowed to stand, the ruling would benefit members of the UPA, other domestic producers, and the domestic vanadium industry. (A significant fraction of the vanadium product in the United States since 1950 has been a coproduct or byproduct of the uranium mined on the Colorado Plateau.)

Federal law currently requires that DOE ensure the viability of the domestic uranium industry, and a comprehensive legislative proposal to revitalize the domestic uranium industry was introduced on April 8, 1986, in the U.S. Senate as an amendment to The Uranium Mill Tailing Reclamation Act of 1985 (S. 1004). The amendment would create a $1 billion uranium mill tailings fund for the cleanup of active tailings sites and would direct the U.S. Trade Representative to seek voluntary restraint agreements with major uranium producing countries such as Canada and Australia. Should trade negotiations fail, U.S. utilities would be required to purchase at least half of their uranium from domestic sources for the rest of the century. Federal agencies, including the Tennessee Valley Authority, would be required to use 100% domestic uranium. The proposed legislation is currently pending in the Senate Energy Committee.

The Secretary of Energy holds that limiting uranium imports is unwarranted and would do little to help the domestic uranium industry.

New Agreement on Imports of Semifinished Steel From EEC: The United States agreed in June to relax quotas on imports of semifinished steel from the European Economic Community (EEC). In return, the EEC will remove import quotas that were imposed on certain products in retaliation for the steel quotas. The steel quotas, which were originally set at 400,000 st/yr, will now be 640,000 st in 1988 and 502,500 st in the first 10 months of 1989. A special additional quota of 200,000 st/yr for British Steel Corp. (BSC) to supply a plant that BSC partly owns in Alabama remains unchanged.

Canadians Promise Fair Market Price on Sale of Potash in United States: Reports on the pricing of Canadian potash imports, prepared by the Bureau of Mines and the Commerce Department at the request of Senator Domenici (R-NM), have resulted in assurances from Canada that it will revise its pricing practices. According to the reports, Canada marketed potash in the United States at substantially lower prices than it did in other countries. Canadian representatives assured U.S. trade negotiators that Canada will no longer sell potash in the United States below fair market value.

STOCKPILE ACTIONS

Antimony and Ferroalloys: On June 9, General Services Administration (GSA) announced the initial offering for sale of excess antimony metal in the National Defense Stockpile to pay for the Government's continuing program to upgrade stockpiled manganese and chromium ores into their ferroalloy form. GSA plans to extend the National Defense Stockpile upgrading program for at least 2 more years. The program, which began in 1984, was intended to ensure an adequate U.S. ferroalloy production capacity by paying industry to convert stockpiled ores into ferroalloys. Although the program was originally conceived as a 10-year effort, GSA had considered canceling it after 1986. Sales will be limited to 150 st/month of antimony metal, not to exceed 1,000 st, per fiscal year. As of May 31, antimony metal in the stockpile totaled 37,843 st and the stockpile goal was 36,000 st.

Tungsten: On July 3, GSA sold its first tungsten concentrate from the Government stockpile since suspending sales in October 1985. The material consisted of 89,745 lb contained tungsten and had been obtained under the Defense Production Act of 1950. It was not subject to the $250 million mandated stockpile fund cap, as it was non-stockpile-grade material. An additional 70,000 lb is expected to be offered later in 1986. These transactions are not expected to affect the tungsten market, but larger sales could have a significant impact on world tungsten prices, which remain low despite high world consumption.

COURT RULINGS

Bankrupt Steel Company's Terminated Labor Contract Overruled: The Third U.S. Circuit Court of Appeals determined that a bankruptcy judge ruled improperly last year that Wheeling-Pittsburgh Steel Corp. could dissolve its labor contract with the United Steelworkers Union. The bankruptcy decision led to a 98-day strike last year by 8,200 steelworkers at 9 plants in West Virginia, Pennsylvania, and Ohio. Wheeling-Pittsburgh, the Nation's seventh-largest steelmaker, has been reorganizing under chapter 11 of the U.S. bankruptcy law since 985. The company had won authorization in a U.S. Bankruptcy Court in July 1985 to dissolve its contract with the union 13 months early and to roll back wages. (See Minerals and Materials, June/July 1985, p. 16; August/September 1985, p. 10; and October/November 1985, p. 9.)

Wisconsin Iron Tax Ruled Unconstitutional: On June 25th, the Wisconsin Supreme Court ruled that a Wisconsin tax of 5¢/lt on certain concentrates moving through Lake Superior docks was unconstitutional because the tax violated the commerce clause of the U.S. Constitution by discriminating against ore mined outside Wisconsin. Under the provisions of the tax, any ore mined in the State would have been exempted. Burlington Northern Dock Corp brought suit against the City of Superior, which received 70% of the tax collected on Minnesota ore moved through the Burlington Northern's iron ore docks. The decision could mean that the City of Superior will have to pay back more than $2 million to the company, which had been paying the taxes under protest for more than 4 years. The effect on future tax collections remains unclear since the State legislature eliminated the exemption for in-State ore and there has been no iron ore production in Wisconsin since 1982. The Wisconsin Attorney General will seek to have the ruling overturned by the U.S. Supreme Court.

INTERSTATE COMMERCE COMMISSION

ICC Denies Southern Pacific's Request To Terminate Unprofitable Rail Line Serving Arizona Copper Industry: On June 13 the Interstate Commerce Commission (ICC) denied the Southern Pacific Transportation Co.'s request to discontinue service on the unprofitable 135-mile Southern Pacific Railroad branch line from Bowie, AZ, to Miami, AZ. The Arizona copper industry and the Arizona Corp. opposed the request because of the importance of the rail link to the copper industry, even though the rail line will require costly repairs. Poor conditions along about half the track necessitate the slowing of rail traffic to 10 mph. Without the rail link, however, shipping costs would have increased significantly for local copper producers. Inspiration Consolidated Copper Co.'s Miami and Sierrita operations are designed for high-volume, heavy-cargo rail transportation and cannot be converted easily to trucking, especially under present economic conditions. Other copper companies also have relied on the rail link at various times; ASARCO Incorporated's Mission Mine, for example, has used the line to transport concentrates to Inspiration for processing.

U.S. MINERAL INDUSTRY HIGHLIGHTS

ALUMINUM

Labor Actions: The United Steel Workers of America (USW) and the Aluminum Brick and Glass Workers International Union (ABGWIU) ended a 5-week strike against the Aluminum Co. of America (Alcoa) on July 3. The unions agreed to a new 3-year contract that cuts benefits and freezes average wages. The USW and ABGWIU also agreed to a similar contract with Reynolds Metals Co., which had coordinated negotiations with Alcoa, but avoided a strike. Supervisory personnel maintained limited production at all plants except Alcoa's Vancouver, WA, smelter, which was permanently closed on June 2 as a result of the strike, declining aluminum prices, and increased electrical power rates.

BARITE AND CLAY

Drop in Drilling Activities Depressing Demand for Barite and Clay: Drilling-related consumption of barite and clay has dropped 60% and 70%, respectively, since December 1981, according to the American Petroleum Institute. Only 809 drilling rigs were in operation in mid-May, 5 fewer than the previous weekly low of 814 set in March 1971. Oil and gas drilling activity is a major consumer of barite and bentonitic clay, accounting for 90% of barite consumption and 60% of bentonite consumption.

COPPER

Contract Agreements Reached: The North American copper industry averted a major supply disruption when strikes at domestic copper companies failed to materialize following expiration of union contracts at the end of June and a month-long strike at Noranda's CCR copper refinery in Quebec was resolved. Contracts ratified at the last minute by copper workers at ASARCO Incorporated, Kennecott, and Newmont generally called for substantial labor concessions. Newmont's 3-year contract, ratified on June 29, calls for a 20% average reduction in the wage and benefit package to about $15.48/h at its Magma and Pinto Valley units. The agreement also included a bonus scheme pegged to the price of copper if COMEX spot prices exceed 70¢/lb. Kennecott's employees voted by a margin of three-to-one to accept an agreement that included a $5.45/h wage reduction package, down from the expired $24/h contract package. The 4-year contract also included a $1,000 bonus for about 3,500 workers and a commitment to take immediate steps to reopen the Bingham Canyon mine unless the COMEX spot price for copper dips below 55¢/lb. It was expected to take about a year to bring the mine back into production at a rate of about one-half its former capacity. Meanwhile, Kennecott was proceeding with its $400 million moderization plan for Bingham Canyon and the associated operations. On July 2, Asarco workers approved a contract that cut hourly wages by $3.50/h but included giveback provisions to take effect in July 1987 and July 1988. On July 18, Inspiration Consolidated Copper Co. workers ratified a 3-year labor contract that reduces average hourly wages about 23%, or $3.10/h. Cost-of-living increases were eliminated, and Inspiration obtained adjustments to the local work rules. Inspiration agreed to restore wages at a rate of 5¢/h when the Comex price reaches 65¢/lb. Industry analysts indicated that the new round of labor contracts could lower production costs for copper by 4¢/lb to 8¢/lb.

DIAMONDS

Process To Coat Surfaces Developed: A form of synthetic diamond that can be deposited on a surface by a low-pressure vapor condensation process has been developed by the Pennsylvania State University. The new continuous-coating process is said to produce a purer, less expensive diamond than that obtained from current high-temperature, high-pressure diamond powder or single-crystal processes. This development should allow such coatings to be used in place of current diamond-containing products such as abrasives, dies, and cutting tools. It also should expand the use of diamonds as coatings on audio speakers and radiation- and heat-resistive transistors. Two Japanese firms plan to introduce diamond-coated audio speakers and transistors in September 1986.

IRON AND STEEL

New Name and Structure for United States Steel: United States Steel Corp. reorganized and renamed itself USX Corp. in July 1986. USX is now a holding company with four operations units. Steelmaking and iron ore mining are combined in a new unit, USS. Marathon Oil Co. and Texas Oil & Gas Corp. continue as two separate subsidiaries, and various other businesses were combined into the fourth subsidiary, U.S. Diversified Group. The new corporate structure will isolate the finances of the company's iron ore and steel operations from other parts of USX.

LTV Corp. Files for Chapter 11 Bankruptcy: LTV Corp., the parent of LTV Steel Co., the second-largest U.S. steel producer, filed for chapter 11 bankruptcy on July 17. LTV Corp. is the largest industrial corporation ever to file for bankruptcy. Weak demand for steel, especially tubular goods used in the oil industry, had led to financial losses and insufficient cash flow to meet the company's needs. While in bankruptcy, LTV Corp. will try to reduce costs by gaining additional labor concessions, eliminating or renegotiating high-cost, long-term supply contracts, and eliminating certain pension liabilities. If LTV can reduce its costs and prices, additional competitive pressure will be placed on other financially weak steel companies, particularly Bethlehem Steel Corp. and Armco Inc. Such companies also face worsening cash flow problems if banks and suppliers become more cautious about extending credit. Armco faces an additional risk because it could be left with the debts from its partnership with LTV in the Reserve Mining Co. The LTV bankruptcy is expected to reinforce the determination of USX Corp. to gain a lower cost labor contract so that it can remain competitive with LTV. Although worker opposition to further concessions appears to be increasing, other steel companies will want to match any further concessions granted to USX or LTV.

ARMCO-USW Labor Contract: Armco Inc. and the United Steelworkers of America (USW) extended their labor contract 3 months beyond its August 1 expiration date to reduce the likelihood of a strike. Most major steel companies except USX Corp. already have reached agreements with the USW.

Bankruptcy Reorganization Extension Requested: Bankrupt Wheeling-Pittsburgh Steel Corp. has requested another 120-day extension for filing its reorganization plan in U.S. Bankruptcy Court. The company was to file the plan on July 14 but delayed meeting that deadline while it decided whether to close the basic oxygen furnace and blast furnace at its plant in Monesson, PA.

USX To Participate in Natural Resources Research Institute in Minnesota: Under an agreement effective July 1, 1986, USX turned over its mineral research laboratory at Coleraine, MN, to the University of Minnesota (Duluth)'s Natural Resources Research Institute (NRRI). The agreement calls for NRRI to operate the laboratory with most of the 50 former USX employees; in turn, USX will contract with NRRI for its beneficiation and agglomeration research. The principal mission of NRRI is to promote employment in Minnesota through the economic development of the State's natural resources in an environmentally sound manner. The transfer of the Coleraine laboratory is part of the restructuring program the former United States Steel Corp. began in 1982 by divesting land and facilities no longer needed to fulfill corporate goals.

Moore McCormack To Sell Iron Ore Operations: On July 24 Moore McCormack Resources Inc. (Stamford, CT) announced its intent to sell its iron ore, coal, silicon metal, and shipping businesses. The firm will retain its operations in cement and concrete products and oil and gas. The businesses to be sold include Pickands Mather & Co. (an iron mine and coal mine managing subsidiary based in Cleveland, OH), Interlake Steamship Co. (a Great Lakes shipping company also based in Cleveland), Moore McCormack Bulk Transport Inc. (an ocean transport firm based in Stamford, CT), and Globe Metallurgical Inc. (a producer of silicon metal and ferroalloys based in Beverly, OH). Roughly half of Interlake's shipping volume has been cargo destined for the steel subsidiary of LTV Corp., which recently filed for chapter 11 bankruptcy (see above). Moore McCormack officials said the shrinking capacity of the steel industry has permanently reduced the profitability of its steel-related assets, and LTV's bankruptcy filing accelerated the company's decision to sell these assets.

MAGNESIUM

Amax Loses State Assistance for Dike Repairs: The State of Utah is unable to provide financial assistance to AMAX Magnesium Corp. for repairing a dike breached during a high windstorm on June 7. The State will not unilaterally help a private industry unless there is a direct benefit to the State. In May, the State Legislature had earmarked $4.3 million to help Amax maintain the dike, which protected Interstate 80 and the Union Pacific Railroad tracks, and also the company's solar evaporation ponds, from the flooding Great Salt Lake. After the breach, however, the Union Pacific railroad bed protected Interstate 80 from damaging floods; consequently, aid to Amax was not granted. Amax is continuing to operate the plant using unaffected inventories while alternate sources of raw materials are evaluated.

POTASH

Lundberg Employees Ratify 3-Year Contract: Potash workers at Lundberg Industries Ltd. (Eddy County, NM) ratified a new 3-year contract on July 15. The International Brotherhood of Electrical Workers, the International Association of Machinists, and the USW, which represent about 330 of the mine's 435 employees, agreed to wage rates of $8.25/h to $12.25/h and several undisclosed changes in benefits. The new agreement concluded 6 months of negotiations that began in January. Lundberg purchased the former Potash Co. of America facilities on December 31, 1985. The contract is expected to make the company more competitive on world potash markets.

SULFUR

Sulfur Export Association Reduces Contract Prices: Amsulex, the U.S. sulfur-exporting association, and Elf-Aquitaine (France) have reduced contract prices $5.50/mt for liquid sulfur in northern Europe, applied to remaining 1986 deliveries. The price cut was brought about by continued reduction in world spot market prices and pressure from European sulfur consumers. Demand for sulfur has dropped sharply this year, and world sulfur shipments have decreased accordingly. U.S. sulfur exports to Europe for the first 5 months of 1986 were 60% below exports for the same period of 1985.

TITANIUM

Strong Titanium Dioxide Market Continues: In response to record high demand, U.S. production of titanium dioxide pigments during the first 4 months of 1986 increased to 309,086 st, nearly 3% above nominal industry capacity. Reflecting this high demand and high production costs, NL Industries Inc. raised its titanium dioxide pigments prices by 6¢/lb, effective July 1, to 84¢/lb for rutile pigment and 80¢/lb for anatase pigment. NL is a major force in U.S. and world markets, with titanium dioxide pigment plants in Canada, Belgium, the Federal Republic of Germany, and Norway.

Selected New Contracts, Investments, Expansions, and Exploration Activities: United States

Commodity and Company	Operation and/or Location	Notes
ALUMINUM		
Ball Corp.	Can-end production, Golden, CO.	Expansion to double aluminum can-end capacity to 2.5 billion ends annually for soft-drink customers throughout the West. The $16 million expansion will provide smaller can ends for assemblage with narrow neck cans at Ball's Fairfield, CA, can body plant, as well as for Ball's Golden can body plant.
Kaiser Aluminum & Chemical Corp.	Primary smelter, Spokane, WA.	Announced recall of about 60 workers and restart of 25,000-mt/yr potline at Mead smelter in August to supply the Trentwood rolling mill. The restart will increase capacity utilization of Mead to 67.5%. The additional line is needed because of increased production at Trentwood and a reduced aluminum ingot supply.
ANTIMONY		
U.S. Antimony Corp.	Antimony mill, refinery, Thompson Falls, MT.	Signed an open-ended contract to buy a minimum of 60 mt/month of antimony ore from a firm representing the Chinese Government. Contract has an option to increase shipments to 120 mt/month.
ASBESTOS		
Vermont Asbestos Group Inc.	Lowell, VT.	Reopened mine in June, recalling 50 workers. Based on current market conditions, the mine is expected to be in operation for 20 weeks and produce 3,000 st asbestos.
CLAY		
Anglo American Clay Corp., subsidiary of ECC America Inc.	Sandersville, GA.	Announced largest expansion in the company's history. Scheduled for completion in December 1986, the expansion will include a 65% increase in production facilities for opacifying pigment and a 25% increase in drying capacity for 3 grades of high-brightness coating clays.
COBALT		
Savanna Resources Ltd.	Turner-Albright deposit, Josephine County, OR.	Announced it has acquired a 72% interest in the polymetallic deposit. Rayrock Mines Inc. holds the remaining interest.
COPPER		
ASARCO Incorporated.	Tucson, AZ.	Will acquire Amax Mining Co.'s interest in the Eisenhower Mine, held in joint venture since 1976. The $1 million purchase price is expected to be paid Apr. 30, 1987, the effective termination date of the partnership agreement.
Washington Corp.	Butte, MT.	Agreement reached between Washington Corp., which purchased Anaconda Minerals' Butte, MT, copper mining properties in September 1985, and Nippon Mining of Japan to sell its projected production of 150,000 mt/yr copper concentrates to Nippon on a long-term contract basis. Washington Corp. is expected to resume mining at the Berkeley pit by September 1986. Though Nippon Mining is the prime contractor, 6 Japanese smelters are expected to be recipients of the concentrates. Before closing in April 1982, Anaconda was selling its annual concentrate production of 240,000 mt to a consortium of 7 Japanese smelters. Washington Corp. has hired 130 workers and is preparing to reopen the mine.
FERROALLOYS		
Elkem Metals Co.	Alloy, WV, Marietta, OH.	The company will spend $10 million to modernize its power-generating facilities at Alloy's silicon metal plant and is contemplating a new $3 million briquetting facility at its Marietta manganese and chromium plants. The modernization of the power generating facility at Alloy should significantly lower the cost of electricity for smelting silicon metal. Construction of a new briquetting plant at Marietta would allow the company to put its chromium aluminum, manganese aluminum, and iron aluminum alloys into briquettes at its own facility.
GOLD		
Cobb Resources Corp.	Alma, CO.	Signed a $16 million joint venture agreement with Colosseum Colorado Inc., an Australian company, for resumption of production at the London Gold mine. Several year of exploration by Cobb Resources and former joint venture partner HNG InterNorth resulted in promising gold discoveries, but HNG withdrew from the project following its merger with Enron Corp., leaving Cobb Resources without the capital to proceed with production.

Freeport McMoRan Gold Co. (60%), Bullrun Gold Mines Ltd. (40%).	Big Springs Gold Project, Elko County, NV.	Announced plans for a new mining operation about 12 miles north of its Jerritt Canyon (Enfield Bell) mining and milling complex, near Elko. Proposed open pit gold mine would produce about 400,000 mt/yr ore from a property within the Humboldt National Forest. A new mill is also planned about 6 miles from the mine site on BLM land. Minable ore reserves are estimated at 2 million st, with an average grade of 0.171 oz/ton Au. Total geologic resource identified to date bears an estimated 0.5 million oz gold.
Gerber Minerals Corp., a subsidiary of Gerber Energy International, Inc.	Silverton, CO.	Will begin operations at the Gold King Mine in July at about 100 mt/d ore. The high quality of ore at the Gold King, up to 15 tr oz/mt Au, is expected to permit production costs of about $140/tr oz Au. Reserves are estimated to be about 915,000 mt high-grade ore.
Homestake Mining Co.	Homestake Mine, Lead, SD.	Members of United Steelworkers Local 7044 ratified a 3-yr contract on June 1 covering some 1,130 workers at the Homestake operations. All active employees will receive $500 bonuses on June 1 and Dec. 1 in lieu of a percentage hourly increase this year. Workers will receive a 3% raise in 1987 and 1988. The contract also calls for increases in insurance benefits, pension benefits, and in the aid fund.
North American Resources and P&G Mining Inc.	Silverton, CO.	Will begin production in July at its Sultan Mountain Mine, employing 80 to 90 people.
U.S. Antimony Corp.	Gold-silver mill, Yankee Fork, ID.	Signed custom milling contracts to process up to 150,000 st/yr ore for 3 companies.

IRON AND STEEL

AlTech Specialty Steel Corp.	Dunkirk, NY.	Purchased by Rio Algom Ltd., Toronto. Rio Algom plans to combine AlTech's operations with those of its Atlas Steel Division in Welland, Ontario. With the change of ownership, AlTech will no longer produce primary specialty steels for its finishing operations, resulting in the loss of 400 jobs at AlTech. Rio Algom's plant will produce specialty steel ingots, billets, forging bars, and rock drill steel, which will be shipped to AlTech for finishing into specialty bar, rod, wire, extruded shapes, and pipe and tube products.
Armco Inc. and United States Steel Corp. (now USX).	Pittsburgh, PA.	Armco Inc. and United States Steel Corp. have agreed to merge their oilfield supply operations. The decline in oilfield activity has resulted in overcapacity in this business. The two companies employ 3,600 workers in their oilfield supply operations; the planned consolidation is expected to result in major layoffs.
New Jersey Steel Corp.	Sayreville, NJ.	Announced a $10 million expansion project at its electric furnace mill. The project will involve installation of new equipment and renovations that will increase production from 350,000 st/yr to 500,000 st/yr. About 95% of the current and proposed production is rebar.
Northwestern Steel & Wire Co.	Wire Products Division, Sterling, IL.	Announced plans for a $4 million modernization program at its Wire Products Division in Sterling. A new cleaning house for rod products should be completed by June 1987. Plans also include purchase of new wire-drawing machines and updating of wire annealers to increase energy efficiency. New cutting machinery will also be installed.
USX Corp. (formerly United States Steel Corp.).	South Works, Chicago, IL.	Transferred structural steel production from a facility near Pittsburgh, PA, to its South Works. About 30 laid-off employees were brought back to work, bringing employment at the plant to 880.
"	Rod mill, Joliet, IL; tow wire plant, Cleveland, OH; Cuyahoga Heights, OH.	Effective in June, U.S. Steel sold its rod mill in Joliet, its tow wire plant in Cleveland, and the shuttered Cuyahoga mill to American Steel & Wire Corp. of Cleveland. The Joliet mill and tow wire Cuyahoga plant (closed),plant will continue to operate with no lost time. The Cuyahoga plant was expected to reopen in mid-August and employ 300 people.
"	Gary, IN.	Dedicated a new $300 million continuous caster, consisting of twin units separated by 4 stories of offices where computers and employees monitor its operation, at its Gary Works on June 4. The Gary caster, one of the 4 entering service this year in northwest Indiana, started operating in April. It can handle 3.3-million st/yr sheet and will increase Gary Works caster reliance to 90% of the mill's total capacity. Continuous casters eliminate several steelmaking steps, save energy, reduce costs, and improve quality.
Wheeling-Pittsburgh Steel Corp.	Benwood, WV.	Joint venture considered with Wheeling-Pittsburgh by executives of the Kao Hsing Chang Iron and Steel Co., Taiwan, who recently visited Wheeling's idled Benwood plant. The partnership would be with the former employees of the plant, who are attempting to form an employee stock ownership plan. The plant, which closed in 1984 because of the lack of sales, employed 200 workers and had manufactured tubular products for the oil industry.

NICKEL		
M. A. Hanna Co.	Riddle operations Douglas County, OR.	Restarted 2 smelting furnaces in early June 1986. Furnaces had been shut down since late December 1985 after problems developed during a test operation of a new "wet screening" process intended to move ore more efficiently from the mine to the smelter. Hanna also temporarily closed its nearby Nickel Mountain Mine at the end of May 1986 to allow the smelter to lower ore stockpiles. Hanna operates the only integrated nickel mine in the country.
PLATINUM GROUP METALS		
Stillwater Mining Co.	Stillwater complex near Nye, MT.	Commenced construction in early May on its 1,000-st/d platinum-palladium mine in the Stillwater Complex near Nye, MT. The initial 100-man work force will be augmented by another 125 workers this fall; production at the $40 million operation should commence in early 1987. Current ore reserves are sufficient for a 25-yr mine life.
POLYMETALLIC SULFIDES		
U.S. Mineral Management Service.	Gorda Ridge, off Oregon-California coasts.	Announced that the U.S. Geological Survey found deposits of polymetallic sulfide minerals around hot water vents at a depth of 10,000 ft.
SILICON METAL		
Elkem Metals Co.	Alloy, WV.	Announced it will spend $10 million to modernize the power generating facilities at its Alloy, WV, silicon metal plant. The modernization program should significantly reduce the plant's electric power costs, a major expense in the production of silicon metal. Elkem Metals and other domestic silicon producers hope that lower production costs and improved product quality will prevent the further erosion of their market share by foreign competitors. Elkem Metals Co., Pittsburgh, PA, is the largest domestic producer of ferroalloys.
M. A. Hanna Co.	Rock Island plant, Chelan County, WA.	Hanna and Textile Workers Union Local 69 reached agreement on a new 2-yr contract, which includes a profit-sharing plan.
STONE, DIMENSION		
Rock of Ages Corp.	Barre, VT.	Purchased Wells-Lamson Quarry Co. for an undisclosed sum, giving it sole ownership of all the operating dimension granite quarries in Barre. Wells-Lamson is the oldest continuously operating quarry in the United States, having produced stone for 160 yr.
TALC		
Vermont Talc Co.	Troy, VT.	Continued exploratory drilling at 500-acre site, seeking a source of talc for the company's mill in Johnson. Vermont Talc currently ships talc 140 miles from its mines in Windham to the Johnson mill.
TIN		
Associated Metal & Minerals Co., parent firm of Tex Tin Corp.	Texas City, TX.	Announced that the smelter will begin smelting tin concentrates for Minsur S.A. of Peru. Minsur plans to market its tin in the United States. Production at the Tex Tin smelter has declined in recent years; the smelter has reportedly been on the market for the past 2 yr. Tex Tin Corp. is the Nation's only tin smelter.
TITANIUM		
Albany Titanium Inc. (ALTI).	Albany, OR.	Plans to begin construction early next year of the first commercial plant to produce titanium sponge and powder from ilmenite ore. Production at the 5,000-st/yr plant, which will be located in the South, should begin about 18 months after construction starts. The company has used a pilot plant at Albany to gather data on the new technology being used.
P. W. Gillibrand Co.	Heavy mineral separation from sand and gravel operation, Soledad, Los Angeles County, CA.	Plans to install additional gravity, electrostatic, and magnetic separation equipment to allow production of 50,000 to 100,000 st/yr concentrates, of which about 33% would be ilmenite, 20% magnetite, 27% apatite, and 6.5% zircon. Gillibrand estimates reserves are over 100 million st titanium dioxide content in alluvial sand, titaniferous magnetite, and gabbro.
TUNGSTEN		
Strategic Minerals Corp. (Stratcor).	Pine Creek Mine and mill, Bishop, CA.	9 former Umetco Minerals Corp. employees have bought out Union Carbide Corp.'s tungsten and vanadium assets, including the Pine Creek operation. Employment at the end of June at Pine Creek was estimated to be 45, down from a peak in 1981 of more than 400. Stratcor, nevertheless, hopes to be producing ammonium paratungstate (APT) by late 1986.
ZINC		
ASARCO Incorporated.	Coy, Immel, and Young Mines near Knoxville, TN.	Reopened 3 of its 4 zinc mines in Tennessee. The Coy, Immel, and Young Mines, which were closed on April 1 because of surplus zinc concentrate stocks and low zinc prices, reopened on June 16, and 300 employees were rehired. Asarco's decision to reopen the mines, which account for about 20% of U.S. zinc production, was based in part on the recent improvement in zinc prices.

Selected New Contracts, Investments, Expansions, and Exploration Activities: International

COUNTRY Commodity and Company	Operation and/or Location	Notes
AUSTRALIA		
COPPER, GOLD, URANIUM		
Roxby Downs Management Services (a Western Mining, BP Minerals, partnership).	Olympic Dam, South Australia.	Formally notified the South Australian Government of its intention to proceed with the development of the mine, including a $A40 million copper copper refinery on site. Production is slated to begin in June 1988 at 90,000 oz/yr gold, 55,000 mt/yr copper, and 2,000 mt/yr uranium.
GOLD		
Battle Mountain Gold Co. of the U.S.	Pajingo gold mine, Queensland.	Announced decision to proceed with development of the Pajingo deposit. Construction of planned 60,000-oz/yr mine contingent upon Queensland government approval. Production is tentatively scheduled to begin by early 1988.
BRAZIL		
FERROMANGANESE		
Government.	Carajas region, Maranhao, northern Brazil.	The Brazilian mining company and the Soviet Union recently agreed to construct a $100 million, 165,000-mt/yr-capacity ferromanganese plant in northern Brazil that is scheduled to begin production in 1990. The Soviet Union is providing 50% of the financing and will receive 50% of the plant's output for at least 12 yr. The project suggests that the Soviets expect to experience a chronic shortfall of high-grade manganese ore in the future. The Brazil-Soviet ferromanganese pact may also affect market economy countries that had hoped to diversify their ferromanganese sources by importing the material from Brazil.
CANADA		
NICKEL		
Inco Ltd.	Thompson Mine, Manitoba.	Announced new open pit nickel mine in Manitoba, Canada, has almost reached full production. The company reports that operating costs have been 50% lower than costs at its underground mines. The new mine gives Inco officials greater production flexibility, for they can adjust output without making major labor changes. Inco expects to produce from 10,000 to 14,000 st/d ore at the facility. The nearby nickel refinery's capacity was expanded from 6 million to 9 million lb/month of nickel to accommodate the mine's production. Production at the new mine will offset earlier reductions in output at the company's high-cost underground mines in Ontario.
CHINA		
ALUMINUM		
Nonfemet International Aluminum Co., Ltd.	Aluminum extrusion and manufacturing plant, Guangdong Province.	Announced joint venture between Alcan Nikkei China Ltd. and China National Nonferrous Metals Industry Corp. to establish an extrusion facility to make and sell high-quality aluminum extrusions for the transportation, communications, and electrical industries in both domestic and export markets. Alcan Nikkei is based in Hong Kong and is jointly owned by Alcan Aluminum Ltd., Canada (50%) and Nippon light Metals Co., Japan (50%). The Nonfemet International plant is expected to come onstream in 1988 at a cost of $20 million.
BROMINE		
Tianjin Municipality Economic and Technological Development Administration.	Tanggu Salt Works, Tianjin.	Soliciting foreign technological and financial assistance to extract bromine from sea water bitterns at the Tanggu Salt Works in Tianjin. The proposed project includes the production of 2,500 to 3,000-mt bromine annually from 5° to 6° Baumé brine, the production of bromine fire-extinguishing chemicals, and the production of magnesium compounds for refractory use.
IRON AND STEEL		
Government.	Iron and steel complex, Baoshan.	Began 2d phase of construction of the Baoshan iron and steel complex with pile driving at the site. When completed in 1991, annual steel capacity at Baoshan will increase from 3.0 million to 6.7 million mt. The blast furnace, sintering plant, and coking plant were to be designed by the Chinese, while tenders were to be given for joint Sino-foreign design of the cold-rolling, hot-rolling, and casting equipment. The new capacity built under the 2d phase was to help reduce China's steel imports. In 1985, China imported 13.1 million mt steel, of which 319,145 mt was from the United States. Completion of the 1st phase of construction was marked by the initial firing of the No. 1 blast furnace in September 1985. During the 1st quarter of 1986, Baoshan produced 1,015,000 mt pig iron, 892,000 mt steel ingot, and 634,000 mt billets.

TITANIUM		
SCM Corp.	Synthetic rutile plant, Sichuan Province.	Plans to extend its titanium dioxide operations into China. As part of a joint venture with International Enertech, Houston, TX, and China's Sichuan Nonferrous Metals Industrial Corp., SCM plans to produce 120,000 mt/yr of synthetic rutile in Sichuan Province. About 70,000 mt of this material would remain in China; a titanium dioxide pigment plant equipped with SCM technology would use more than half of this amount. SCM would export the remaining 50,000 mt. The continued world demand for titanium dioxide pigment has encouraged a number of companies to expand their production capacity.
GREECE		
LEAD, ZINC, GOLD, SILVER		
Aegean Metallurgical Industries SA (METEA).	Amphipolis, Molai.	After several years of study the Government-owned Aegean Metallurgical Industries SA (METEA) decided to proceed with the construction of a $400 million lead-zinc metallurgical complex near Amphipolis in northern Greece. One phase of the project will be a 120,000-mt/yr pyrite treatment plant to extract up to 96,000-tr oz/yr gold and 129,000-tr oz/yr silver from mined and stockpiled material from the Olympias Mine in northern Greece. Construction should start in 1989. The study for this unit is to be completed this summer by a U.S. consulting firm, Fluor Mining & Metals of California. Another phase will be development of the 3.5-million-mt deposit at Molai in the Peloponnesus, which should start operation in 1989 with an output of around 45,000-mt/yr lead concentrates and 6,000-mt/yr zinc concentrates. The construction of a lead-zinc smelter near Molai would start in mid-1988.
GREENLAND		
LEAD AND ZINC		
Boliden AB.	Black Angel Mine.	Bought the nearly depleted mine for about $3 million from Vestgron Mines Ltd. on July 15. Vestgron wrote off the mine in 1985 and had planned to shut it in mid-1986 unless a buyer was found. Boliden expects to be able to operate the mine for about 2 yr before the ore runs out. However, the company was exploring other deposits in the area and expected to delineate additional ore to extend operations. Additional payments to Vestgron are contingent on the sale of 57,000 mt metal, contained in con-centrate, mined but not sold before the effective mine purchase date. Recent annual production has been about 80,000 mt zinc in concentrate and 20,000 mt lead in concentrate.
ITALY		
STEEL		
Government.	Cornigliano, Italy.	In early July, a group of private companies signed a letter of intent to buy a 68% interest in the state-owned integrated steel plant at Cornigliano. Production of flat rolled steel was ended in 1984 when the plant's production quota was transferred to a different plant. Cornigliano was reopened in mid-1985 to produce blooms and billets, some of which are sold to some of the companies that now intend to buy the plant to replace high-cost production from electric furnaces.
JAPAN		
TITANIUM		
Ishihara Sangyo Kaisha Ltd.	Osaka.	Announced plans to build a 72,000-mt/yr titanium dioxide plant in Jurong, Singapore, at a cost of about $176 million. Ishihara is planning construction in 2 phases, with the 1st 36,000 mt/yr of capacity due to be completed in mid-1989. The Singapore site was chosen because of the fast-growing Southeast Asian market and to avoid the effects of the rising value of the yen. The company has access to a long-term supply of titanium dioxide concentrates through its part-ownership in Westralian Sands Ltd., which is expected to bring a synthetic rutile plant into production at Capel, Western Australia, in 1987.
MALAYSIA		
IRON AND STEEL		
Perwaja Terengganu Sdn. Bhd. (owned 70% by Heavy Industries Corp. of Malaysia and 30% by a Japanese consortium led by Nippon Steel Corp.).	Telokkalong, Trengganu.	Plans new bloom caster and medium section mill to expand product range.

MEXICO		
COPPER		
Mexicana de Cobre (44% state-owned).	Nacozari, Sonora.	Mexico's new $333 million Nacozari smelter was dedicated, and the groundbreaking for its pollution-controlling acid recovery plant took place on June 1. Located 60 miles south of the U.S. border, the smelter, associated with La Caridad copper mine, will produce 630 mt/d copper anodes and emit nearly 1,250 mt/d sulfur dioxide when it reaches full capacity. Two other smelters in the border area--1 in Cananea, Mexico, and 1 in Arizona--already produce more than 1,100 mt/d sulfur dioxide. The operator, Mexicana de Cobre S.A.--a mixed capital company with minority Government participation--has already constructed a 940-ft smokestack to disperse the pollutants. In 1985, however, Mexican officials agreed to construct an additional $50 million acid plant at Nacozari to capture sulfur dioxide. In exchange, the United States promised that the Arizona smelter would be in compliance with Federal and State emission standards by January 1988, when the Nacozari acid plant is scheduled for completion; i.e., before the smelter reaches design capacity.
NORWAY		
ALUMINUM		
Norsk Hydro Aluminum Division.	Companies headquartered in Oslo.	Signed an agreement to merge with Ardal og Sunndal Verk (ASV), Norway's largest aluminum producer. Norsk Hydro will own 70% of the shares of the new company. The new company, with total sales of $1.15 billion, is to pursue expansion of its aluminum shape fabrication activities both at home and abroad. Parliamentary approval of the merger appears imminent.
MAGNESIUM		
Elkem AS.	Sauda.	Plans to construct a 15,000-mt/yr magnesium plant. The plant, which will produce magnesium by the silicothermic method, is scheduled to be completed in 1988 at a cost of $70 to $75 million.
PERU		
GOLD AND SILVER		
Cia. de Minas Orcopampa S.A.	Mine in Castilla Province, Arequipa Department.	The International Finance Corp. approved a $9 million credit and a $1 million equity interest toward a $30 million expansion project due to be completed by mid-1987. Mine production is to be increased from 500 to 1,000 mt/d. Included in the project is a 3-MW hydroelectric plant, workers' housing, and mine exploration and development. An additional $5 million credit was being sought from the International Development Bank.
South American Placers (Peru) SA and Ausorsa Group.	Caichive and Huepetue River area, Madre de Dios.	Received $6 million from International Finance Corp., a World Bank affiliate, to develop gold placer deposits in southeastern Peru. Project expected to produce about 30,000 tr oz/yr gold. IFC is also making a $500,000 equity investment in the $24 million project. Other financing was expected in the form of suppliers' credits from Brazil.
POLYMETALLICS		
Cia. Minera del Madrigal S.A. and Cia. Minerales Santander Inc.	Mine in Caylloma Province, Arequipa Department, and mine in Huaral Province, Lima Department.	St. Joe Mineral Corp. sold the Madrigal and Santander Mines to a United States, West German, and Peruvian group called Docarb S.A. St. Joe will receive $3 million. The group will spend $2 million for exploration and development at the Santander operation and to close the Madrigal Mine. Docarb is a holding company for Cia. Minera Katanga S.A., which will have a 51% interest in Santander and Madrigal.
ZINC		
Cia. Minera San Ignacio de Morococha S.A.	San Vicente Mine, Chanchamayo Province, Junin Department.	Expansion of mine capacity from 1,800 to 3,000 mt/d underway with completion expected by June 1987. Production costs expected to be reduced from present $16/mt to $10/mt. The company signed a tax stability agreement with Government. A 50,000-mt/yr slab zinc refinery is proposed to be built at San Ramon in Junin Department. The cost of the refinery was estimated at $80 million, plus $29 million for a 30-MW hydroelectric plant. Fluor Engineers Inc. was expected to prepare a technical and economic feasibility study.
PHILIPPINES		
NICKEL		
Nonoc Mining and Industrial Corp.	Mines and refinery near Surigao, Nonoc Island.	Resolved its labor dispute. The company reportedly was awarded a $20 million governmental loan that will enable it to settle backpay issues with mine workers and to modernize the nickel refinery near Surigao, which has been closed since March. The loan may permit a reopening with full capacity of 1,800 mt/month 2 to 3 months after startup. World nickel production was curtailed last spring by strikes in Australia, Norway, and Dominican Republic; tightening nickel supplies have pushed prices up 6¢/lb to 7¢/lb over the last 3 months.

SULFUR		
ICI-Sulfex.	Sulfur mining and processing operations in Iba, Zambales Province.	Signed a $25 million joint venture contract with Sulfex of the United States to develop a sulfur mine and construct a 2,000- to 3,000-mt/d processing plant in Iba. Development of the surface mine is expected to start in the 2d half of 1986.
SIERRA LEONE		
TITANIUM		
Sierra Rutile Ltd. (SRL), owned by Nord Resources Corp. (Dayton, OH).	Rutile mining and concentrating plant, Mogbwemo.	Plans to increase the capacity of its rutile mining and concentrating operations in Sierra Leone by 40%, to about 125,000 mt/yr, by adding dredge to be completed by early 1987. Since 1983, when SRL purchased Bethlehem Steel Co.'s 85% of the project, its entire production has been sold out. Achieving this increased production rate will involve an investment of about $8 million; Nord spent a similar amount in 1985 to upgrade its Sierra Leone rutile mills. The company's titanium dioxide rutile product is marketed widely to titanium dioxide pigment manufacturers in the United States and Europe. Demand for titanium dioxide pigment has been at record levels since 1982; the price of rutile concentrate has increased from $200/mt to $425/mt over the past 3 yr.
SOUTH AFRICA, REPUBLIC OF		
PLATINUM GROUP METALS		
Gold Fields of South Africa Ltd.	Northam, Western Transvaal, Republic of South Africa.	Announced that it will go ahead with plans to develop a new platinum group metals (PGM) mine near Northam in the Western Transvaal. Northam Platinum, a GFS subsidiary, will develop the operation, which could have a mill throughput of 150,000 mt/month grading 0.324 tr oz PGM per metric ton ore. Project cost is said to be $214 million and mine life is a minimum of 25 yr. Output is estimated at 250,000 tr oz/yr PGM, compared with current production of 3.7 million tr oz for all of South Africa.
SPAIN		
SPECIALTY ALLOYS		
Ferroaleaciones Especiales Asturianas S.A. (Ferroastur).	Plant in Aviles, Asturias.	Will hold a 60% interest in a new venture called Aleaciones Asturianas. The other 40% is controlled by Promocion de Desarrollo de Asturias. Aleaciones Asturianas plans to invest Ptas 291m ($2.0 million) in a facility to produce aluminum alloys, such as strontium-aluminum, boron-aluminum, and titanium-aluminum. The Aleaciones Asturianas project is receiving regional aid because of its location in Asturias, plus a Ptas 100m ($676,000) subsidy from the Ministry of Industry's technological and industrial development center. Ferroastur already produces approximately 2,000 mt ferroaluminum, 1,200 mt ferromolybdenum, 250 mt 70% ferrotitanium, and 300 mt ferrovanadium annually at its Aviles plant in Asturias. The Aviles plant, commissioned in 1977, has a 1,200-kV·A electric arc furnace and a 780-kV·A induction furnace.
SWEDEN		
TUNGSTEN		
Government Economic Defense Board.	Mine and mill at Yxjoberg.	Agreed to subsidize the country's sole scheelite concentrate mine and mill. A "strategic preparedness loan" will keep the facility open for 4 more yr. The mine, operated by AB Statsgruvor, which is a subsidiary of LKAB, produced 388 mt contained tungsten in 1985, about half of Sweden's consumption, but has operated at a loss for more than 2 yr because of depressed world concentrate prices. The Swedish Government believes that keeping the mine in operation is more economical than tying up capital in stockpiling tungsten.
UNITED KINGDOM		
IRON AND STEEL		
British Steel Corp.	Shotton Works at Deeside, Clwyd.	Started new 200,000-mt/yr hot-dip galvanizing line at the end of May.

Selected Closings, Postponements, Layoffs, and Production Decreases: United States

Commodity and Company	Operation and/or Location	Notes
ALUMINUM		
Aluminum Co. of America (Alcoa).	Primary smelter, Vancouver, WA.	Permanently closed the 110,000-mt/yr smelter on June 2, 1986. Smelter was operating at 60% of annual capacity and had been offered for sale by Alcoa.

CALCIUM AND MAGNESIUM COMPOUNDS		
Dow Chemical Co. and Martin Marietta Corp.	Ludington, MI (Dow); Manistee, MI (Martin Marietta).	Abandoned plans announced last March for a joint venture that involved marketing specialty chemicals produced by the Ludington and Manistee plants and other facilities located in Woodville, OH, Bridgeport, CT, and River Rouge, MI. No reasons were given for the decision. The companies said that they will now explore "potential alternative business approaches."
COPPER		
Phelps Dodge Corp.	Douglas, AZ.	Temporarily closed its Douglas, AZ, copper smelter on July 10 and began to lay off 300 workers to avoid violating Federal air-pollution standards. Reopened smelter on July 30 at greatly reduced operating rate. (See "U.S. Mineral Industry Highlights" for further details.)
FERROMANGANESE		
Chemetals Inc.	Kingwood, WV.	Will not reopen its Kingwood ferromanganese plant in West Virginia. The plant closed in November 1985 because of flood damage. Chemetals had been producing low- and medium-carbon ferromanganese at Kingwood with a fused-salt electrolytic process. In June 1986, the company entered into a 5-yr agreement to market a similar French-made product throughout North America. Elkem Metals Co. now operates the only ferromanganese plant in the country.
IRON AND STEEL		
LTV Steel Co.	Cleveland, OH.	Temporarily idled a blast furnace and several related production facilities at its Cleveland Works because of a drop in orders for flat-rolled products and continued competition from imported steel. The company has already laid off 1,300 hourly workers and expects to add another 400 employees to their number; these layoffs will affect almost 80% of the hourly workers at the Ohio operation. These latest cutbacks are the largest at the Cleveland Works since LTV Steel was formed 2 yr ago.
USX Corp. (formerly United States Steel Corp.).	Illinois and Ohio.	Announced that it will sell its wire rod plants in Illinois and Ohio to the newly formed American Steel & Wire Corp., a Chicago West Pullman Corp. subsidiary. USX will provide semifinished billets to American Steel & Wire for conversion into special quality rod.
"	Fairless Works, Bucks County, PA.	Laid off 500 workers because of decline in demand. About 2,700 workers are employed at Fairless, down from 8,000 in 1974.
Wheeling-Pittsburgh Steel Corp.	Blast and oxygen furnaces, Monessen, PA.	Shut down blast and basic oxygen furnaces at its rail mill complex in late June. The closing will cause layoffs of 600 of the 870 workers at the plant. The decision was made because the furnaces, even when operated at only 35% capacity, exceeded the production need at the rail mill. The rail mill will continue to operate using billets from other plants. Electric furnaces may be installed eventually. Wheeling-Pittsburgh is in bankruptcy and is reorganizing.
IRON ORE		
Erie Mining Co. (owned by LTV Steel Co.).	Hoyt Lakes, MN.	The Hoyt Lakes operation was shut down from June 15 to July 19. The shutdown was scheduled so that the workers could have a 5-wk summer vacation. On July 24, in the wake of LTV Corp.'s July 17 chapter 11 bankruptcy declaration, LTV Steel Co. announced plans to increase taconite production at Hoyt Lakes from the current 2 million lt/yr to full capacity (8 million lt/yr).
Reserve Mining Co. (50% Armco Inc. and 50% LTV Steel Co.).	Babbitt and Silver Bay, MN.	LTV Steel Co. apparently will abandon its 50% equity in Reserve Mining Co. LTV's actions have forced Armco Inc. to shut down Reserve's operations indefinitely.
LEAD		
Bergsoe Metal Corp.	St. Helens smelter, Columbia County, OR.	Fine of $16,000 imposed on secondary lead smelting and car battery recycling facility by the Oregon Department of Environmental Quality after high levels of cadmium and lead were discovered at the site. Bergsoe closed the facility at the end of June because it could not buy liability insurance.
MOLYBDENUM		
Climax Molybdenum Co. (subsidiary of AMAX, Inc.).	Climax and Henderson Mines, CO.	Plans to further reduce production by 30% in the second half of 1986. The 2 mines have been operating at about 50% capacity for a 6-month output of about 22.5 million lb molybdenum. The proposed production schedule will yield about 15.75 million lb molybdenum in the second half of 1986. Both mines closed June 30 for a summer vacation and maintenance period. Climax plans to reopen August 4, Henderson July 21. Most of the 515 employees at Climax and 850 employees at Henderson are affected. The Henderson Mine reports improved efficiency resulting in production of approximately 45 mt/worker shift, compared with past production of about 20 mt/worker shift. Of the 2 mines, only Climax is unionized, and negotiations are underway to renew current contracts, which expired July 15. It has been reported that Amax will ask for pay and benefit reductions. Reduced demand for molybdenum and foreign competition have lowered the price of molybdenum from about $9.45/lb in 1980 to an average of about $3.25/lb in 1986. Amax has reduced total employment by about 21% and is selling off its lead, potash, phosphate, and nickel operations.

PHOSPHATE		
Beker Industries Corp.	Fertilizer plant, Conda, ID.	Announced shutdown on May 20 of phosphate fertilizer plant. An estimated 150 salaried and 225 hourly employees are affected.
J. R. Simplot Co.	Fertilizer plant Pocatello, ID.	Started a 6-wk production halt on June 27, furloughing 400 out of 540 employees. The 1st summer shutdown in 42 yr of operations was triggered by a declining farm economy.
POTASH		
PPG Industries Inc.	Osceola County, MI.	Downsized plans for a new potash facility announced last year. The operation initially would produce 375,000 st/yr of potash, about half the amount originally proposed, and would employ slightly more than 100 of the 200 employees originally projected. Tests have been run since July 31, 1985, at a new experimental solution mining facility. Results of the $5 million testing program are expected in the near future. A decision to build a commercial facility will depend on whether the potash market improves. The earliest a determination can be expected will be next spring. Construction would then take about 2 yr.
Western Ag-Minerals Co.	Carlsbad, NM.	Announced shutdown of mine and mill at Carlsbad from Aug. 10 through Oct. 5 because of diminished market for sulfate of potash-magnesia, a fertilizer experiencing reduced demand because of the drought in the Southeastern United States. The company is 1 of 2 companies producing the chemical in Carlsbad and employs about 70 workers at its mine and about 100 at its mill.
SAND, INDUSTRIAL		
Valley Mold & Iron Co. and Vulcan Mold & Iron Co.	South Chicago, IL; Lansing, IN.	Notified Valley Mold & Iron workers in May that the company is shutting down permanently because of the lack of current business and future prospects. With the introduction of 3 additional casters early this year in the Calumet, IN, region, most of the region's mills are producing steel without molds. Vulcan has been idled since Jan. 1. The growing number of continuous casters at steel mills is depressing the demand for industrial sand used to make ingot molds.
SILVER		
Bunker Limited Partnership.	Crescent Mine, Kellogg, ID.	Ceased production on May 30, idling 60 workers. Current depressed silver prices are insufficient to meet ongoing development costs. The Crescent Mine, the only remaining operating segment of the Bunker Hill mining and smelting complex that closed in 1981, had reopened in late 1983. In January 1986, operations at the mine were reduced by 50%; workers were divided into 2 teams that worked alternate 2-wk periods. In announcing the shutdown, a company spokesman stated that Crescent could break even mining developed ore at $5/oz, but that ongoing development costs could not be met at current silver prices.
TIN		
American Can Co.	Greenwich, CT.	Announced the sale of its packaging operations to Triangle Industries Inc. for about $570 million in cash and stock, ending the company's 85 yr in the container business. The sale completes the company's 5-yr move away from the capital-intensive packaging industry and into financial services and retailing. Until 1985, when it purchased National Can Co., Triangle had no stake in the container field. Triangle is now the largest domestic producer of beverage cans.

Selected Closings, Postponements, Layoffs, and Production Decreases: International

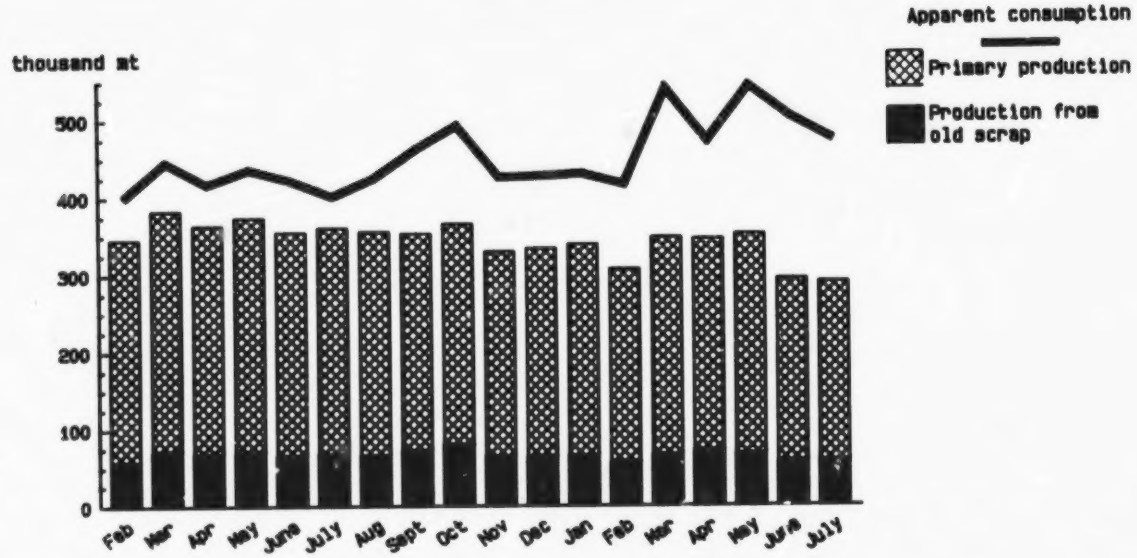
COUNTRY Commodity and Company	Operation and/or Location	Notes
AUSTRALIA		
TIN		
Associated Tin Smelters Pty. Ltd.	Sydney.	Closing set for July of Associated Tin Smelters Pty. Ltd., the largest of 2 tin smelters in Australia. In recent years, the plant has produced about 2,500 mt/yr of refined tin, considerably less than its 7,400-mt/yr capacity.

BOLIVIA		
ZINC		
Corporacion Minera de Bolivia (Comibol), Empresa Minera Matilde.	Matilde Zinc Mine, near Lake Titicaca.	The mining industry of Bolivia is severely depressed because of the general decline in mineral prices. At prevailing prices, all of State-owned Comibol's mines are extremely unprofitable. In 1985, Comibol lost $150 million, and the Government predicts similar losses for 1986. Most private mines are also losing money, and a few have been closed. The Matilde Mine is the 1st Comibol mine to be shut down completely. Matilde's workforce of 568 is being cut to 137. The remaining positions are mostly administrative and maintenance jobs. Mineworker jobs were cut from 271 to 24. In 1985, the Matilde Mine produced 9,282 mt zinc, and total Bolivian production was 37,110 mt. The mine has ore reserves sufficient for only 3 yr of production at the 1985 rate of output. Because of excessive rainfall in 1985-86, Lake Titicaca flooded the Matilde port facilities, thus making operations untenable. Matilde exports its production in barges across the Lake to Port of Puno (Peru) and thence by rail to Matarani (Chile).
CANADA		
NICKEL		
Inco Ltd.	Ontario Division mines.	Began 5-wk vacation and 5-wk production shutdown June 2.
"	Manitoba Division mines.	Began 4-wk vacation and 5-wk production shutdown July 7.
TUNGSTEN		
Canada Tungsten Mining Corp.	Tungsten, Northwest Territories.	Strike began May 20 of the United Steelworkers' hourly employees at the mine and mill of the Canada Tungsten Mining Corp., 57% owned by AMAX Inc. Employees rejected the company's contract offer, which called for a 15.5% reduction in wages and benefits. The mill, which is the largest producer of tungsten concentrate in the world, has operated at a loss during the past 4 yr because of low world tungsten prices.
GERMANY, FEDERAL REPUBLIC OF		
IRON AND STEEL		
Mannesmann AG.	Tube and pipe operations at Duisburg, Dusseldorf, and Mulheim.	Plans to reduce workforce by 6,500. Reduction is attributed to the slump in oil and gas drilling.
INDONESIA		
NICKEL		
P.T. International Nickel Indonesia.	Soroako Mine, Sulawesi Island (formerly Celebes).	Began 6-wk vacation and production shutdown June 2.
SPAIN		
LEAD		
Cia. La Cruz.	La Cruz.	The plant, which produced 40,000 mt lead concentrates in 1985, has suspended operations and will likely close permanently because of company cash flow problems.
THAILAND		
TIN		
Government.	Countrywide.	Thai officials report that 221 tin mines, or 37% of Thailand's total, ceased operations during the 1st 4 months of the year.
U.S.S.R.		
POTASH		
Government.	Ural Mountains.	Recent flooding of a 1-million-mt/yr potash mine in the Ural Mountains may reduce the world potash supply, thereby helping U.S. potash producers who now face poor market conditions. Decreased production from the Soviet mine, however, is expected to be less than that suggested by its stated capacity because potash beneficiation plants in the Urals rarely operate at more than 50% of capacity.
SULFUR		
Government.	Volga delta region.	Falling seriously behind schedule in development of the Astrakhan sour gas field. Sulfur production from the field, scheduled to begin later this year, had been expected to meet the U.S.S.R.'s domestic needs and provide significant quantities for export. The sulfur industry had counted on Astrakhan production to compensate for the expected depletion of Canadian stocks. Analysts believe that delayed Soviet production could create a serious shortfall in world sulfur supplies by 1990, driving prices up significantly.

MINERAL DATA SERIES

ALUMINUM
CHROMIUM
COBALT
COPPER
IRON ORE
LEAD
MANGANESE
NICKEL
PLATINUM-GROUP METALS
STEEL
TITANIUM METAL
ZINC

ALUMINUM



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

Year	/ Month	Apparent consumption	Production: Primary	Production: From old scrap	Imports	Exports	Inventories: Private	Inventories: Government	Price[3] (¢/lb)
1981		4,615	4,489	758	848	787	2,996	2	76.0
1982		4,370	3,274	782	878	748	2,812	2	76.0
1983		5,035	3,353	820	1,091	776	2,265	2	77.8
1984		5,279	4,099	825	1,477	734	2,653	2	81.0
1985		5,172	3,500	850	1,420	908	2,343	2	81.0
1985:	Feb	399	289	58	97	79	2,629	2	81.0
	Mar	445	312	72	129	76	2,621	2	81.0
	Apr	415	295	70	110	78	2,603	2	81.0
	May	435	304	71	121	75	2,589	2	81.0
	June	420	288	68	119	107	2,537	2	81.0
	July	399	292	70	109	79	2,530	2	81.0
	Aug	423	289	68	113	78	2,499	2	81.0
	Sept	460	280	74	149	73	2,469	2	81.0
	Oct	491	285	82	135	65	2,415	2	81.0
	Nov	423	265	66	115	60	2,378	2	81.0
	Dec	425	271	64	106	51	2,343	2	81.0
1986:	Jan	428	273	67	131	45	2,341	2	81.0
	Feb	413	251	57	151	47	2,340	2	81.0
	Mar	538[r]	281	68	175	34	2,292[r]	2	81.0
	Apr	469[r]	275	72[r]	175[r]	33[r]	2,312[r]	2	81.0
	May	541	284	69	202	38	2,288	2	81.0
	June	500	237	58	198	31	2,250[e]	2	81.0
	July[e]	471	231	60	195	35	2,230	2	81.0

See footnotes at end of section.
Data prepared August 20, 1986.

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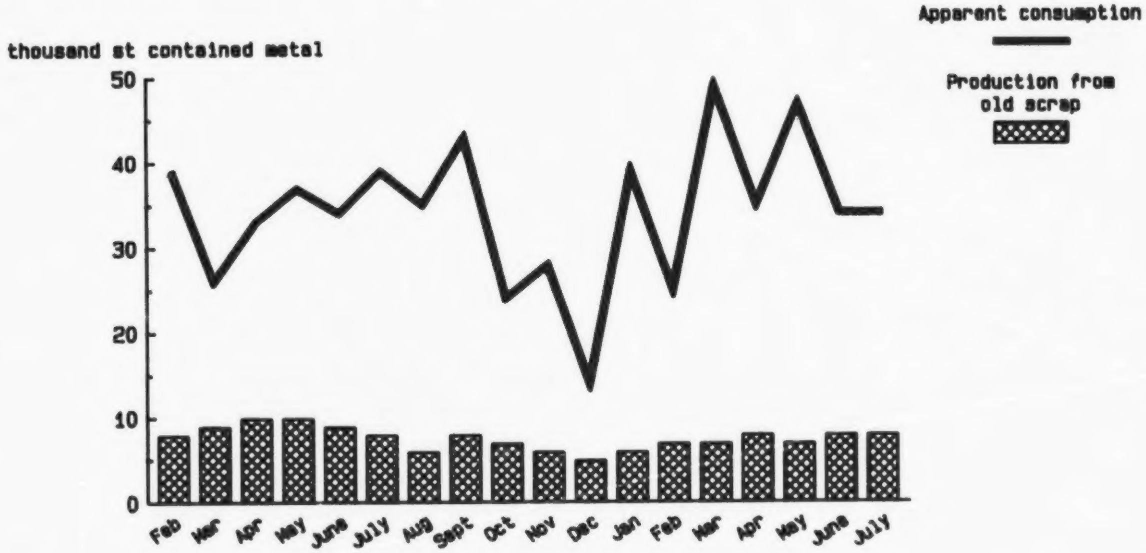
CHROMIUM



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

	---Consumption---		--Production--				---Inventories---		
Year/Month	Apparent	Reported[1]	Primary	From old scrap	Imports[3]	Exports[3]	Private[4]	Government[5]	Price ($/mt)[6]
1981	510	349	0	55	508	52	251	1,325	51-55
1982	319	232	0	48	239	10	209	1,325	48-52
1983	329	301	0	77	231	13	175	1,325	48-52
1984	437	355	0	81	332	25	118	1,325	48-52
1985[p]	378	338	0	94	304	26	112	1,325	42-45
1985: Feb	39	29	0	8	30	0	122	1,325	48-52
Mar ...	26	30	0	9	11	0	116	1,325	48-52
Apr	33	29	0	10	20	2	110	1,325	48-52
May ...	37	31	0	10	24	0	107	1,325	40-42
June ..	34	29	0	9	35	0	118	1,325	40-42
July ...	39	26	0	8	34	1	120	1,325	40-42
Aug ...	35	25	0	6	26	0	117	1,325	40-42
Sept ...	43	26	0	8	49	19	112	1,325	40-42
Oct	24	26	0	7	16	0	110	1,325	40-42
Nov ...	28	22	0	6	27	6	109	1,325	40-42
Dec ...	14	27	0	5	14	0	114	1,325	40-42
1986: Jan	39	29	0	6	54	1	133	1,325	40-42
Feb	25	25	0	7	34	0	149	1,325	40-42
Mar ...	49	27	0	7	30	0	138	1,325	40-42
Apr	35	28	0	8	18	0	127	1,325	40-42
May[e] ...	47	29	0	7	50	1	137	1,325	40-42
June[e] ..	34	28	0	8	26	0	137	1,325	40-42
July[e] ...	34	28	0	8	26	0	137	1,325	40-42

See footnotes at end of section.
Data prepared August 20, 1986.

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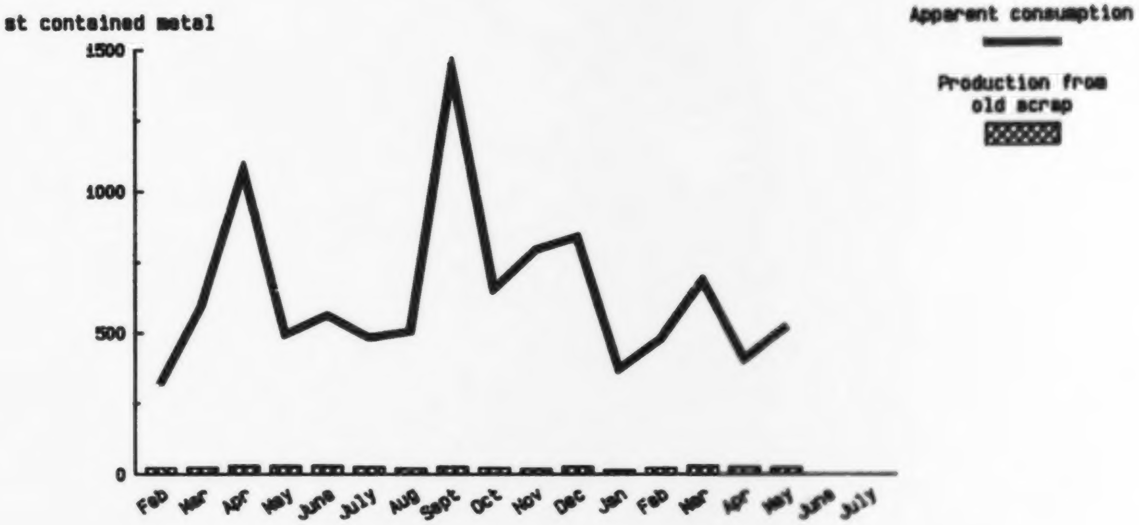
COBALT



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

Year / Month	Consumption: Apparent	Consumption: Reported	Production: Primary	Production: From old scrap[1]	Imports	Exports[2]	Inventories: Private[3]	Inventories: Government	Price ($/lb)[4]
1981	6,266	5,840	0	486	7,797	417	4,188	21,566[5]	NA
1982	5,725	4,734	0	436	6,435	300	3,733	22,866	8.56
1983	7,856	5,660	0	362	8,611	412	4,304	22,998	5.76
1984	8,948[6,8]	6,472	0	440	9,950	336	5,629	23,097	10.40
1985	NA	6,771	0	333	8,854	314	NA	26,592	11.43
1985: Feb	323	437	0	25	253[7]	25	1,341	23,097	11.52
Mar ...	603	499	0	27	534[7]	27	1,273	23,097	11.57
Apr	1,077	503	0	33	1,103[7]	32	1,300	23,097	11.61
May ...	494	486	0	33	433[7]	27	1,244	23,097	11.57
June ..	564	431	0	34	547[7]	25	1,236	23,097	11.53
July ...	482	352	0	29	522[7]	30	1,275	25,096	11.48
Aug ...	506	403	0	24	538	33	1,297	25,096	11.45
Sept ...	1,430	445	0	30	1,579	21	1,455	25,096	11.32
Oct	655	478	0	26	650	6	1,471	25,096	11.32
Nov ...	796	441	0	22	735	16	1,416	25,096	11.25
Dec ...	842[6]	376	0	30	746	20	1,331	26,592	11.15
1986: Jan	371[r]	414[r]	0	18[r]	561	81	1,457[r]	26,592	10.97
Feb	481[r]	386[r]	0	25[r]	469	33	1,436[r]	26,592	10.63
Mar ...	688	466	0	33	560	39	1,303	26,592	10.24
Apr	407	463	0	29	396	17	1,305	26,592	9.60
May ...	523	414	0	27	412	48	1,172	26,592	8.73
June[e] ..	NA	NA	0	NA	403	5	NA	26,592	6.88
July[e] ...	NA	NA	0	NA	NA	NA	NA	26,592	5.20

See footnotes at end of section.
Data prepared August 20, 1986.

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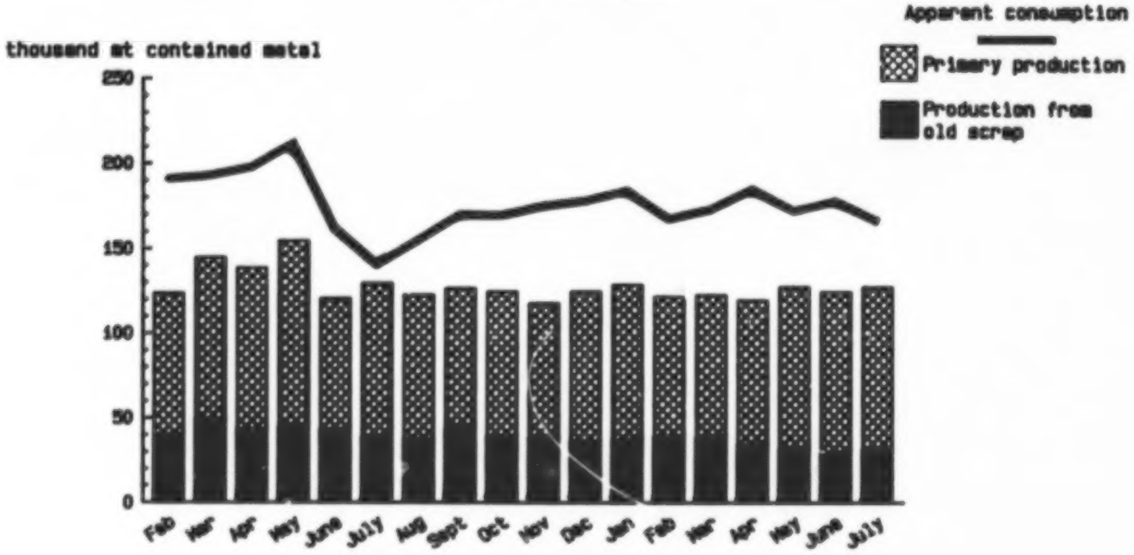
COPPER



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

Year / Month	Apparent consumption	Production[1] Primary	Production[1] From old scrap	Imports[2]	Exports[2]	Inventories Private[3]	Inventories Government	Price (¢/lb)[4]
1981	2,271^{r}	1,544	592^{r}	331	24	465	20	84.2
1982	1,762	1,227	518	258	31	676	20	72.8
1983	2,014	1,182	449	460	81	672	20	76.5
1984	2,106^{r}	1,164^{r}	461^{r}	445	91	544^{r}	20	66.8
1985	2,153^{r}	1,051^{r}	503^{r}	378	38	291^{r}	20	66.9
1985: Feb	191	83^{r}	41^{r}	19	3	457^{r}	20	66.5
Mar	193	95	50	31	7	433^{r}	20	65.5
Apr	198^{r}	95^{r}	44^{r}	22	2	394^{r}	20	70.3
May	212^{r}	102^{r}	46^{r}	27	10	346^{r}	20	69.9
June	161^{r}	77^{r}	44^{r}	42	3	345^{r}	20	67.1
July	140	91^{r}	39^{r}	26	4	357^{r}	20	66.8
Aug	155^{r}	85^{r}	38	25	5	345^{r}	20	66.3
Sept	170^{r}	82^{r}	45^{r}	33	1	335	20	65.7
Oct	169^{r}	85^{r}	40^{r}	19	1	310^{r}	20	66.7
Nov	175^{r}	79^{r}	39	43	1	296^{r}	20	66.3
Dec	178^{r}	88^{r}	37^{r}	49	1	291^{r}	20	68.0
1986: Jan^{e}	184	91	38	50	1	285^{r}	20	69.9
Feb^{e}	167	82	40	41	1	280	20	68.2
Mar^{e}	173	83	40	46	1	275	20	70.2
Apr^{e}	185	85	35	41	1	250	20	68.8
May^{e}	172	96	32	40	1	245	20	67.0
June^{e}	178	94	31	45	2	235	20	67.5
July^{e}	166	96	32	40	2	235	20	63.5

See footnotes at end of section.
Data prepared August 20, 1986.

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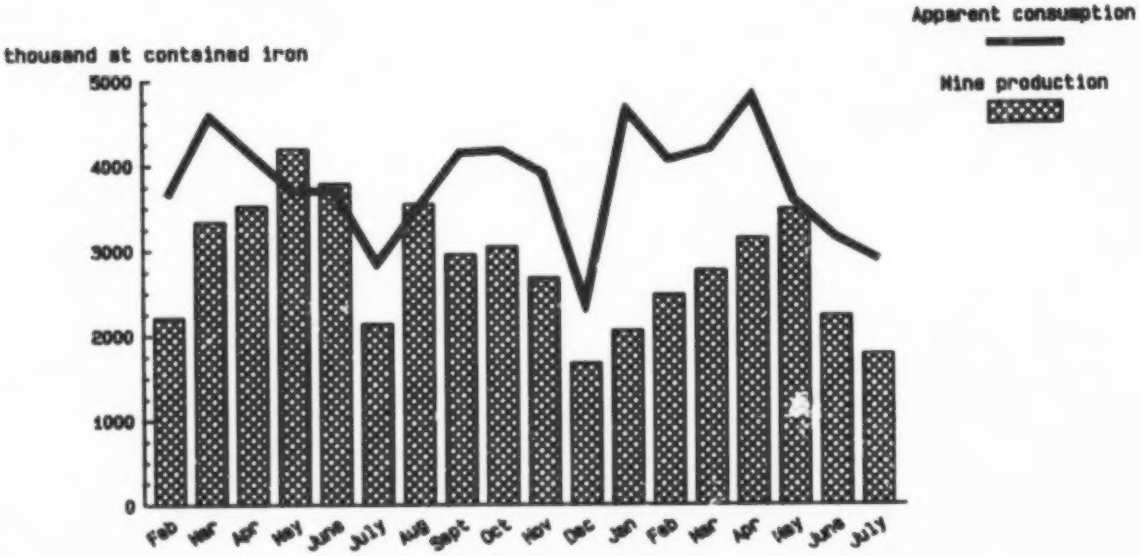
IRON ORE



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = mine production + (imports - exports) + (beginning inventories - ending inventories).

Year / Month		----Consumption---- Apparent[2]	Reported[2]	Mine production[3]	Imports	Exports	Industry stocks[4]	Price ($/st)[5]
1981		64,800	67,000	52,400	20,000	3,900	42,500	71.88
1982		41,800[6]	39,300	25,400	10,250	2,300	34,100	71.88-77.20
1983		42,900	43,400	27,100	9,400	2,700	23,200	71.88-77.59
1984		45,800	47,000	37,100	12,100	3,600	23,000	58.93-77.59
1985[e]		44,257	45,346	35,034	11,119	3,598	21,189	51.79-77.59
1985:	Feb	3,663	3,584	2,223	401	0	20,695	58.93-77.59
	Mar	3,585	4,218	3,348	653	1	10,110	58.93-77.59
	Apr	4,130	4,020	3,535	682	141	20,056	58.93-77.59
	May	3,690	4,307	4,207	615	389	20,799	58.93-77.59
	June	3,696	3,854	3,798	925	478	21,348	58.93-77.59
	July	2,841	3,729	2,148	933	419	21,169	58.93-77.59
	Aug	3,518	3,694	3,558	1,178	400	21,987	58.93-77.59
	Sept	4,155	3,500	2,963	2,109	580	22,324	51.79-77.59
	Oct	4,179	3,629	3,055	920	262	21,858	51.79-77.59
	Nov	3,899	3,621	2,686	1,068	364	21,349	51.79-77.59
	Dec	2,368	3,622	1,682	893	367	21,189	51.79-77.59
1986:	Jan[e]	4,660	3,901	2,067	912	9	19,499	51.79-77.59
	Feb[e]	4,061	3,710	2,487	831	0	18,756	51.79-77.59
	Mar[e]	4,202	3,933	2,774	813	102	18,039	51.79-77.59
	Apr[e]	4,830	3,864	3,152	1,019	156	17,224	51.79-77.59
	May[e]	3,585	3,809	3,495	1,217	381	17,970	51.79-77.59
	June[e]	3,146	3,316	2,237	1,357	421	17,997	51.79-77.59
	July[e]	2,889	3,208	1,784	1,369	369	17,892	51.79-77.59

See footnotes at end of section.
Data prepared August 22, 1986.

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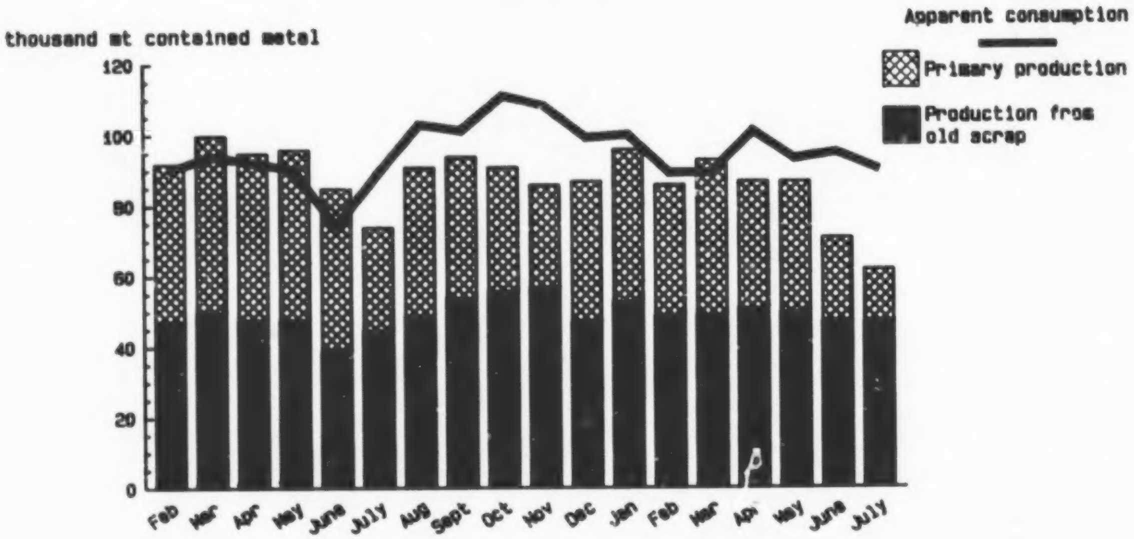
LEAD



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

Year / Month		Apparent consumption	---Production--- Primary	From old scrap	Imports	Exports	---Inventories--- Private	Government	Price (¢/lb)
1981		1,132	498	578	101	23	203	545	36.53
1982		1,109	517	521	95	56	171	545	25.54
1983		1,136[r]	515	452	177[r]	20	159	545	21.68
1984		1,195	397	628	163	7	145	545	25.55
1985		1,153	487	594	131	27	177	545	19.07
1985:	Feb	90	45	47	11	1	125	545	18.82
	Mar	94	50	50	14	2	143	545	17.68
	Apr	92	47	48	11	1	156	545	19.92
	May	90	48	48	9	1	170	545	20.11
	June	74	46	39	8	0	189	545	19.05
	July	89	29	45	8	1	181	545	18.88
	Aug	103	42	49	11	7	173	545	19.10
	Sept	101	40	54	12	11	167	545	19.20
	Oct	111	35	56	10	2	155	545	18.93
	Nov	108	29	57	14	0	147	545	19.05
	Dec	99	40	47	12	1	146	545	18.97
1986:	Jan	100	43	53	10	1	151	545	18.35
	Feb	89	37	49	12	1	159	545	17.79
	Mar	89	44	49	10	1	172	545	18.20
	Apr	101	36	51	9	1	166	545	18.73
	May	93	37	50	10	1	169	545	19.34
	June	95	24	47	12	1	156	545	22.07
	July[e]	90	15	47	12	0	140	545	21.94

See footnotes at end of section.
Data prepared August 20, 1986.

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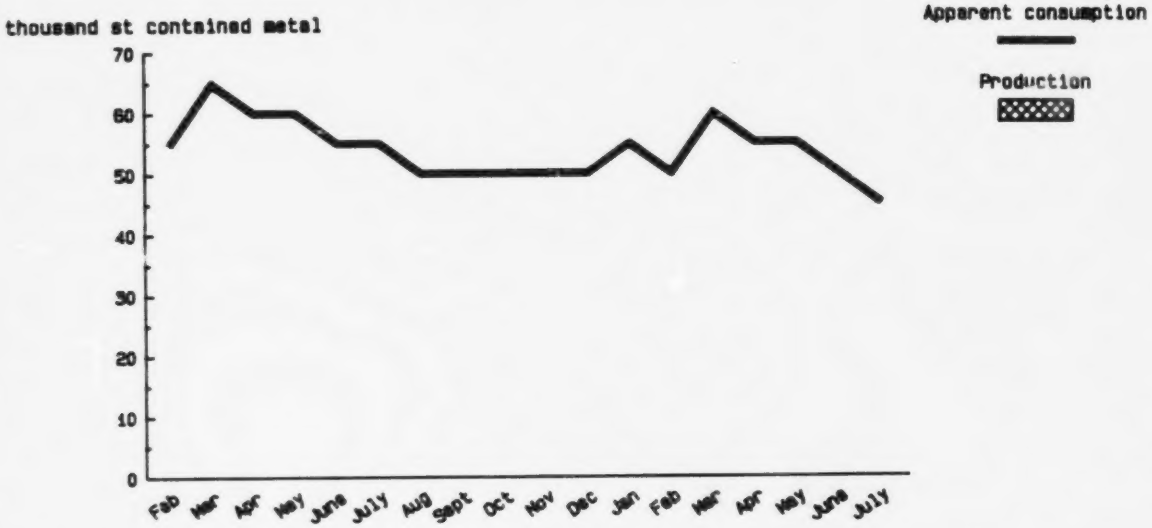
MANGANESE



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

Year / Month	Apparent consumption	Production: Primary	Production: From old scrap	Imports[2]	Exports	Inventories: Private[3]	Inventories: Government	Price ($/LTU)[4]
1981	1,027	24	0	916	49	702	2,169	1.72
1982	672	4	0	541	27	576	2,141	1.58
1983	668	4	0	542	27	462	2,206[5]	1.38
1984	627	11	0	606	43[5]	420[5]	2,197	1.42
1985	698	2	0	609	44[6]	380	2,106	1.43
1985: Feb	55	0	0	50	2	238	2,184	NA
Mar	65	0	0	61	2	241	2,175	NA
Apr	60	0	0	84	2	267	2,171	NA
May	60	0	0	25	8	235	2,160	NA
June	55	0	0	45	3	229	2,153	NA
July	55	0	0	65	1	239	2,152	NA
Aug	50	0	0	40	4	225	2,152	NA
Sept	50	0	0	35	6	244	2,112	NA
Oct	50	0	0	59	2	256	2,107	NA
Nov	50	0	0	69	1	275	2,106	NA
Dec	50	0	0	39	5	259	2,106	NA
1986: Jan	55	0	0	67	6	281	2,090	NA
Feb	50	0	0	79[r]	1	311[r]	2,088	NA
Mar	60	0	0	45	1	296[r]	2,087	NA
Apr	55	0	0	68	1	315	2,080	NA
May	55	0	0	42	3	299	2,080	NA
June[e]	50	0	0	60	2	308	2,079	NA
July[e]	45	0	0	55	2	320	2,075	NA

See footnotes at end of section.
Data prepared August 11, 1986.

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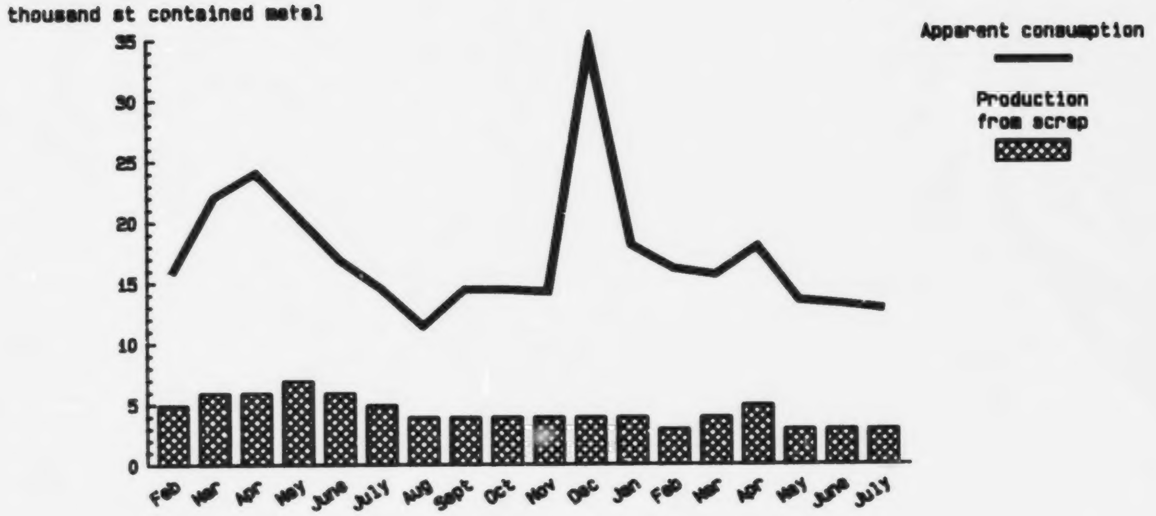
NICKEL



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from scrap + (imports - exports) + (beginning inventories - ending inventories).

	--Consumption--		--Production--				------Inventories------			Price[6] ($/lb)	
Year / Month	Appar.	Rptd.[1]	Primary[2]	From scrap[3]	**Imports**	**Exports**[4]	Consumer	Producer[5]	Government	Producer	U.S. spot
1981	206	145	10	52	209	20	23	100	32	3.43	2.67
1982	181	104	3	43	130	37	19	62	32	3.20	2.24
1983	202	128	W	51	152	23	20	39	32	3.20	2.20
1984	218	137	10	58	177	28	21	37	32	3.20	2.22
1985	219	120	5	57	158	22	19	13	37	3.20	2.26
1985: Feb	15.9	11	NA	5	11	1.4	14	NA	32	3.20	2.32
Mar	22.1	11	NA	6	17	1.8	13	NA	32	3.20	2.36
Apr	24.1	10	NA	6	18	1.6	12	NA	32	3.20	2.46
May	20.5	10	NA	7	15	1.8	12	NA	32	3.20	2.51
June	16.9	9	NA	6	13	1.8	12	NA	32	3.20	2.50
July	14.5	8	0	5	11	2.4	11	NA	32	3.20	2.35
Aug	11.4	8	0	4	7	1.9	9	NA	32	3.20	2.32
Sept	14.5	8	0	4	16	2.0	9	NA	37	3.20	2.17
Oct	14.4	8	NA	4	12	1.4	9	NA	37	3.20	2.02
Nov	14.2	7	NA	4	12	.3	9	NA	37	3.20	1.90
Dec	34.7	7	NA	4	15	.4	17	13	37	3.20	1.93
1986: Jan	18.0	9	NA	4	11	.2	14	NA	37	3.20	1.90
Feb	16.1	9	NA	3	12	.5	13	NA	37	3.20	1.88
Mar	15.6	9	NA	4	11	.7	11	NA	37	3.20	1.92
Apr	18.0	9	NA	5	13	.2	11	NA	37	3.20	1.89
May	13.5	8	NA	3	11	.2	11	NA	37	3.20	1.94
June[e]	13.2	8	NA	3	11	.2	11	NA	37	3.20	1.95
July[e]	12.8	8	NA	3	11	.2	11	NA	37	3.20	1.88

See footnotes at end of section.
Data prepared August 20, 1986.

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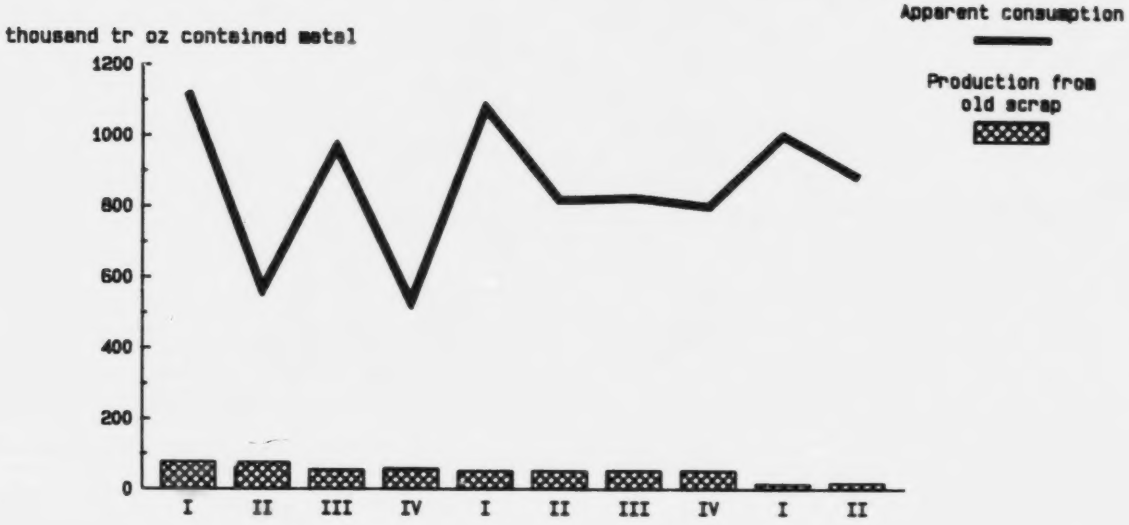
PLATINUM-GROUP METALS
(PLATINUM, Palladium, Iridium, Osmium, Rhodium, Ruthenium)



1ST QUARTER 1984 THROUGH 2D QUARTER 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

		---Production[1]---				---Inventories---		--Price-- ($/tr oz)[5]	
Year / Qtr	Apparent consumption	Primary	From old scrap[2]	Imports[3]	Exports[3]	Private[4]	Government	Pt	Pd
1981	2,445	7	392	2,846	855	918	1,725	475	130
1982	1,820	9	344	2,489	827	1,107	1,731	475	110
1983	2,482	9	303	3,207	1,197	943	1,735	475	130
1984	3,312	24	340	4,454	1,121	1,319	1,744	475	147
1985	3,473	5	259	3,969	885	1,191	1,747	475	127
1984: I	1,120	NA	80	1,313	273	901	1,735	475	137
II	563	NA	78	1,095	229	1,282	1,735	475	150
III	968	NA	57	1,177	261	1,287	1,735	475	150
IV	528	NA	61	869	356	1,324	1,744	475	150
1985: I	1,080	NA	54	1,148	310	1,133	1,747	475	148
II	815	NA	54	884	232	1,024	1,747	475	120
III	824	NA	55	965	160	1,060	1,747	475	120
IV	797	NA	55	971	183	1,106	1,747	475	120
1986: I	1,001[r]	NA	18	1,191	227[r]	1,087	1,747	475	120
II	882	NA	20	1,046	170	1,101	1,747	475	120

See footnotes at end of section.
Data prepared August 20, 1986.

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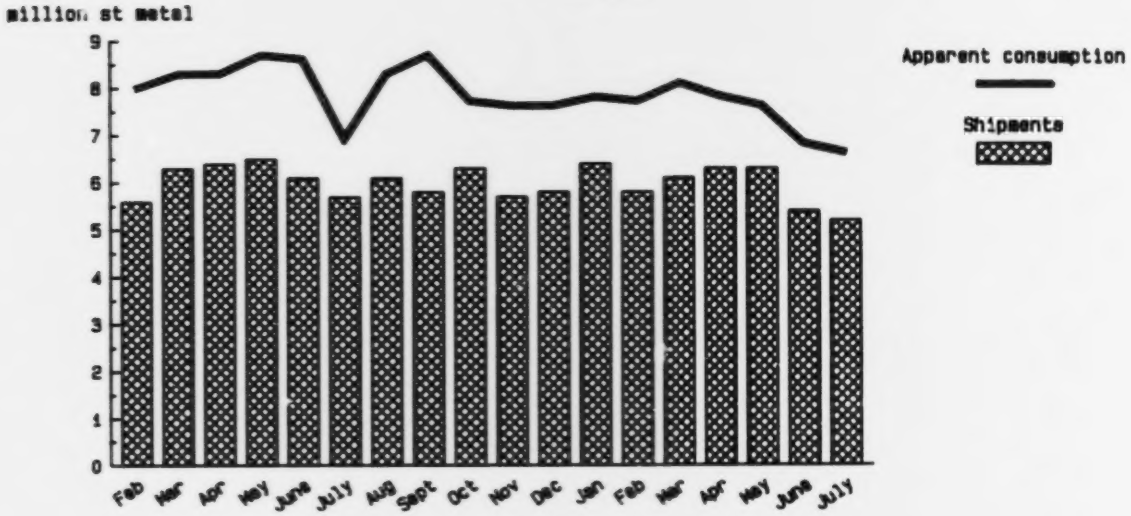
STEEL



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = shipments + (imports - exports) + (beginning inventories - ending inventories). (Consumer and service center inventories only.)

Year / Month		Production of raw steel[2]	Apparent consumption	Shipments[2]	Imports[3]	Exports[3]	Private inventories[4] Steel mill[5]	Private inventories[4] Consumer & service center	Price ($/st)[6]
		STEEL MILL PRODUCTS[1]							
1981		120.8	106.0	88.4	19.9	2.9	18.7	11.3	484
1982		74.6	78.8	61.6	16.5	1.8	13.4	8.8	505
1983		84.6	81.6^{r}	67.6	17.0	1.2	12.8	11.1[7]	524
1984		92.5^{r}	98.0^{r}	73.7^{r}	26.2	1.0	13.6	12.0	545
1985		88.3	96.0^{r}	73.0^{r}	24.3	.9	13.6^{r}	9.9[8]	552
1985:	Feb	6.9	8.0^{r}	5.6	2.1	.1	13.5^{r}	11.0^{r}	552
	Mar	8.3	8.3	6.3	2.0	.1	13.9^{r}	11.0^{r}	552
	Apr	7.9	8.3^{r}	6.4	1.9	.1	14.0^{r}	11.0^{r}	552
	May	7.8	8.7^{r}	6.5	2.0	.1	13.9^{r}	10.7^{r}	552
	June	7.3	8.6^{r}	6.1	2.4	.1	13.7^{r}	10.5^{r}	552
	July	7.0	6.9	5.7	1.6	.1	13.9^{r}	10.8^{r}	552
	Aug	7.1	8.3^{r}	6.1	2.0	.1	13.7^{r}	10.5^{r}	552
	Sept	6.9	8.7^{r}	5.8	2.5	.1	13.6^{r}	10.1^{r}	552
	Oct	7.4	7.7	6.3	1.3	.1	13.3^{r}	10.0^{r}	552
	Nov	7.1	7.6^{r}	5.7	1.7	.1	13.4^{r}	9.6^{r}	552
	Dec	6.7	7.6	5.8	2.1	.1	13.6^{r}	9.9^{r}	552
1986:	Jan	7.7	7.8	6.4	1.7	.1	13.4^{r}	10.2^{r}	492
	Feb	7.2	7.7^{r}	5.8	2.0	.1	13.5	10.3	492
	Mar	7.9	8.1^{r}	6.1	2.0	.1	13.5	10.2	492
	Apr	7.8	7.8	6.3	1.6	.1	13.6	10.3	492
	May	7.6	7.6	6.2	1.6	.1	13.7	10.5	492
	June	6.7	6.8	5.4	1.6	.1	13.9	10.6	497
	July	6.5	6.6	5.2	1.6	.1	14.0	10.7	497

See footnotes at end of section.
Data prepared August 4, 1986.

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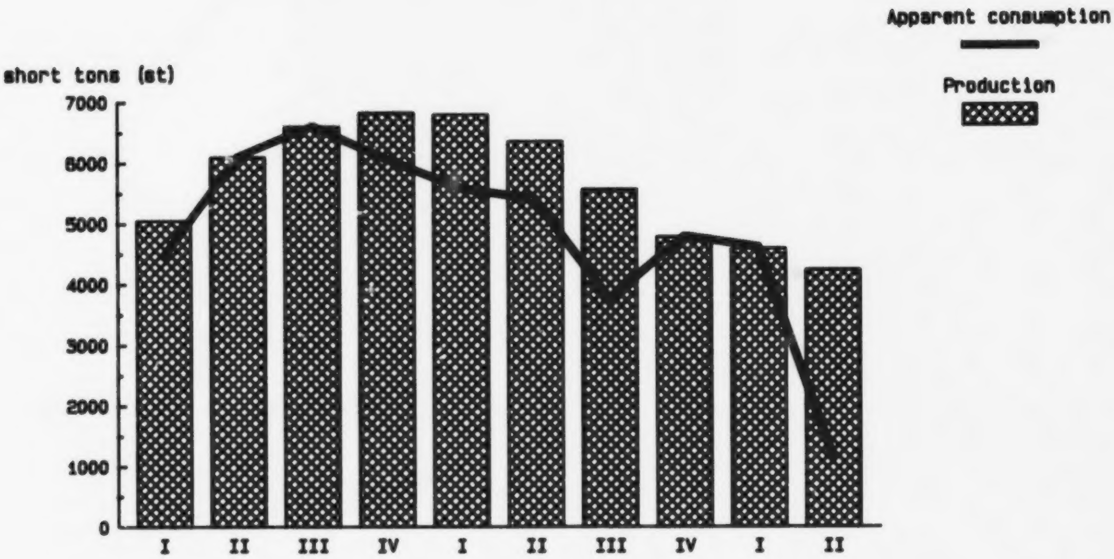
TITANIUM



1ST QUARTER 1984 THROUGH 2D QUARTER 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

		---Production---				------Inventories------			
Year / Qtr	Apparent consumption	Primary	From old scrap	Imports	Exports	Sponge^{e}	Other^{e,2}	Govern-ment	Price ($/lb)^{3}
1981	23,891	26,506	300	11,639	9,643	3,720	14,083	32,331	7.65
1982	12,521	15,639	300	3,795	8,103	3,350	13,563	32,331	5.55
1983	7,857	13,966	300	3,785	8,061	3,136	15,900	32,331	5.55
1984	21,682	24,326	300	5,533	7,333	3,147	17,033	32,470^{5}	5.55
1985	18,356^{r}	23,257	300	5,478	10,384^{r}	4,755	15,720	36,831^{5}	5.55
1984: I	4,470	4,988	75	1,221^{4}	1,828	3,312	15,710	32,331	5.55
II	5,025	6,035	75	1,700^{4}	2,142	3,553	16,112	32,331	5.55
III	6,135	6,538	75	1,367^{4}	1,450	3,835	16,225	32,331	5.55
IV	6,052	6,765	75	1,250^{4}	1,913	3,147	17,033	33,470^{5}	5.55
1985: I	5,569	6,736	75	1,190	2,644	3,419	16,549	33,069^{5}	5.55
II	5,392	6,295	75	1,775	2,688	3,985	16,048	35,826^{5}	5.55
III	3,741^{e}	5,505	75	1,411	2,412	4,639	16,232	36,831^{e,5}	5.55
IV	3,654^{r}	4,721	75	1,102	2,640^{r}	4,755	15,720	36,831^{e}	5.55
1986: I	4,164	4,530	75	1,407	2,523	3,930	15,870	36,831	3.75 - 3.95
II	1,147	4,177	75	1,481	4,507	3,576	16,303	36,831	3.75 - 3.95

See footnotes at end of section.
Data prepared August 20, 1986.

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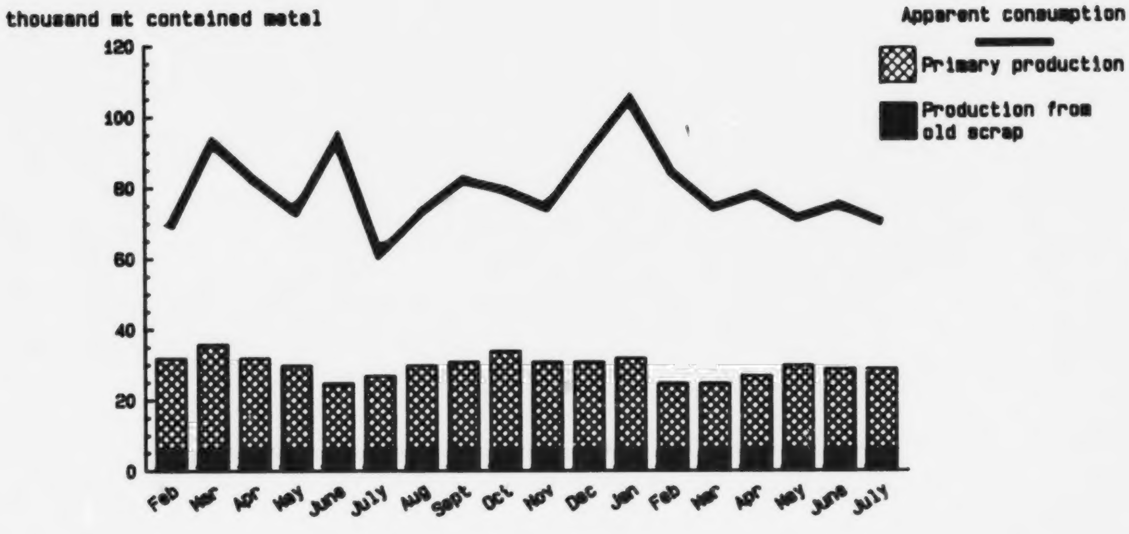
ZINC



FEBRUARY 1985 THROUGH JULY 1986

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

Year / Month		Apparent consumption	----Production---- Primary[1]	From old scrap[2]	Imports[3]	Exports[4]	---Inventories--- Private	Govern-ment	Price (¢/lb)[5]
1981		1,000	397	86	620	35	195	341	44.6
1982		833[r]	302	62	463	30[r]	159	341	38.5
1983		988[r]	305	76	625	29[r]	148	341	41.4
1984		1,027	331	81	645	40	138	341	48.6
1985		976[r]	312[r]	74[r]	616	45	119[r]	341	40.4
1985:	Feb	69	26	6	40	3	120	341	42.6
	Mar	93	30	6	52	5	110	341	43.2
	Apr	82	26	6	53	4	109	341	44.9
	May	73	24	6	41	3	104	341	45.1
	June	94	19	6	70	3	102	341	43.7
	July	61	21	6	46	3	111	341	41.4
	Aug	73	24	6	42	3	107	341	39.8
	Sept	82	25	6	54	4	106	341	37.9
	Oct	79	28	6	42	4	99	341	35.8
	Nov	74	25	6	65	8	113	341	33.4
	Dec	90	25	6	67	3	118	341	33.9
1986:	Jan	105	26	6	75	4	116	341	32.9
	Feb	84	19	6	59	5	111	341	30.9
	Mar	82	19	6	58	5	107	341	31.2
	Apr	83	21	6	50	6	95	341	32.1
	May[e]	70	24	6	50	5	100	341	33.0
	June[e]	75	23	6	55	4	105	341	36.5
	July[e]	70	23	6	55	4	110	341	39.5

See footnotes at end of section.
Data prepared August 20, 1986.

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GENERAL NOTES

Numbers in the mineral data series are from the Bureau of Mines, except for imports and exports (Bureau of the Census) and Government inventories (General Services Administration), or as cited in the footnotes below. Inventory figures are for the end of the period.

Monthly figures are independently rounded. They exclude year-end revisions and may not add to monthly apparent consumption annual totals.

Footnotes Used

e/ = Estimate p/ = Preliminary r/ = Revised W = Withheld NA - Not available

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FOOTNOTES, BY COMMODITY

ALUMINUM

1 Aluminum metal consumption only. Nonmetallic uses of bauxite and alumina in chemical, abrasive, and refractory materials represent, on an aluminum metal equivalent, an additional 10% apparent industrial demand.

2 Source: U.S. Department of Commerce.

3 Primary producers' list prices. Annual figures are Bureau of Mines averages. Monthly figures are producers' list prices as quoted by Metals Week. The average market or spot prices quoted by Metals Week were 56.7¢/lb for June and 54.1¢/lb for July.

Note: As of the December 1985 / January 1986 issue, aluminum data are presented in metric tons rather than short tons. To convert metric tons to short tons, multiply by 1.10231.

CHROMIUM

1 Before January 1984: in alloys, by metallurgical industry, and in chromite, by refractory and chemical industries. Since January 1984: in alloys, by metallurgical industry, and in chromite, by metallurgical, chemical, and refractory industries. Estimates do not include yield losses in production or make adjustments for an incomplete indusiry survey.

2 Estimated chromium content of stainless steel scrap received by steel industry.

3 Chromium content of chromite and chromium alloys.

4 Producer and consumer inventories of alloys and metal and consumer inventories of ores.

5 Chromium contained in specification-grade chromite, chomium ferroalloys, and chromium metal.

6 Transvaal ore, f.o.b. South Africa.

COBALT

1 Reported consumption of purchased scrap.

2 Content of unwrought cobalt, cobalt alloys, and waste and scrap.

3 End-of-month stocks at processor and consumer establishments only for monthly data.

4 Weighted average based on weekly price quoted by Metals Week.

5 Estimated as consigned to the stockpile based on import data.

6 Apparent consumption figure does not reflect change in Government inventory; this change represents acceptance of imports that occurred prior to 1984.

7 Import figure does not include quantity of cobalt destined for stockpile.

8 Due to minor adjustments in calculation of private inventories, apparent consumption for year 1984 is not based on 1983 stock data.

COPPER

1 Refined metal and metal used in production of alloys, from domestic and foreign ores, and old scrap.

2 Unwrought refined copper.

3 Refined copper held at primary producers' plants, wire mills, brass mills, chemical plants, foundries, and miscellaneous plants, and in Commodity Exchange, Inc. warehouses.

4 U.S. producers delivered price, listed as "U.S. Producer Cathode" in Metals Week. Revised from previous quotes for wirebar.

Note: Revised as of April/May 1984 issue to delete scrap from import and export figures.

IRON ORE

1 Data estimated except for annual mine production.

2 Based on gross weights reported by American Iron Ore Association.

3 Calculated from data reported to Bureau of Mines by U.S. producers.

4 Includes usable ore reported at U.S. mines, docks, and consuming plants, end of month. After 1982, excluding byproduct ore at mines. Prior data unchanged for proprietary reasons.

5 Based on published end-of-month prices for Lake Superior iron ore pellets, delivered rail-of-vessel at lower Great Lakes ports, per LTU of iron, natural basis.

6 Due to adjustment of mine stocks (see footnote 4), apparent consumption for year 1983 is not based on December 1982 stock data.

LEAD

1 Monthly canvass adjusted to reflect annual canvass and exclude approximately 7% new scrap.

MANGANESE

1 Manganese contained in manganiferous ore.

2 Includes manganese dioxide as of 1984.

3 Producer and consumer inventories of alloys and metal and consumer inventories of ores.

4 Average price per LTU, metallurgical ore containing 46% to 48% manganese.

5 Reflects inventory adjustments.

6 Adjusted for reexports.

NICKEL

1 Primary nickel.

2 Contained nickel in ferronickel.

3 Estimated. Includes new and old scrap.

4 Exports of unwrought nickel, powder, flakes, and electrolytic anodes.

5 U.S. producer and producer's agent stocks.

6 Producer listed price of cathode nickel; yearly weighted average. Spot prices of cathode nickel; weighted average annual and monthly prices.

PLATINUM-GROUP METALS

1 Refined metal.

2 Non-tolled scrap. Breakdown between old and new scrap not available.

3 Refined metal and scrap metal.

4 Refined metal held by refiners, importers, dealers. Includes platinum and palladium in New York Mercantile Exchange warehouses.

5 Quarterly and annual averages of weekly major-producer prices.

STEEL

1 Not including iron and steel foundry products.

2 American Iron and Steel Institute (AISI).

3 Compiled by AISI from Bureau of the Census reports.

4 Steel mill shapes and forms, reported by Bureau of the Census.

5 Includes steel in process and finished steel.

6 Average composite price of finished steel, reported in Iron Age.

7 Revised series beginning in 1983.

8 Revised series beginning in 1985.

TITANIUM METAL

1 Calculated sponge metal production = sponge consumption - sponge imports + exports and adjustments for Government and industry stock changes.

2 Usually over 75% scrap.

3 End-of-period list price for sponge through 1985; estimated sales price range in 1986. Actual sales prices from 1982 through 1985 were mainly in a range of $3.50/lb to $4.50/lb.

4 Excludes sponge imported by GSA for the Strategic Stockpile.

5 Not included in calculations of apparent consumption.

ZINC

1 Monthly production figures reported by American Bureau of Metal Statistics, Inc. (ABMS) do not include all data from companies reporting annually to Bureau of Mines.

2 Monthly old scrap figures based on a percentage of the total secondary zinc produced during the month.

3 Imports for consumption of slab zinc, fume, dross, and skimming.

4 Consists of unwrought zinc, zinc content of waste, and scrap and dross.

5 Metals Week monthly average price for High Grade zinc.

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BUREAU OF MINES ★ UNITED STATES DEPARTMENT OF THE INTERIOR

60 COMPLETED

Minerals and Materials

A Bimonthly Survey

August/September 1986

CONTIN

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J# 704017
556 copies

MINERALS
and
MATERIALS

A Bimonthly Survey

August/September 1986

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald Paul Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

I

FOREWORD

The economy grew more slowly than expected during the second quarter. Some metal and mineral producers reported improved earnings compared with those of the second quarter of 1985.

Featured in this issue of Minerals and Materials are excerpts of a report recently submitted to Congress by the Secretary of the Interior on the mineral position of the United States; and remarks by the Director, Bureau of Mines on the state of the mining industry in the Northwestern United States. Also included are FEMA'S stockpile goals and inventories, updated to June 30, 1986.

George White, Editor
November 15, 1986

Publication Staff:
Keith Harris
David Quick
Mary Willis

ACKNOWLEDGMENTS

Mineral information and data are provided by the commodity and country specialists, research personnel, and State mineral officers of the Bureau of Mines.

The Bureau of Mines will consider for publication authoritative articles on any facet of mineral resource development and use. The Bureau makes no commitment to publish such articles in advance of editorial and policy reviews.

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UNIT ABBREVIATIONS

°C = degree Celsius
¢/lb = cent per pound
cm = centimeter
d = day
f.o.b. = freight on board
g/L = gram per liter
g/mt = gram per metric ton
h = hour
in = inch
kW•h = kilowatt hour
L = liter
lb = pound
lb/yr = pound per year
lt = long ton = 2,240 pounds
LTU = long ton unit: In sales of ores, concentrates, or metals, a unit is 1% of the specified substance. A ton of 1% ore contains 1 unit. A ton of 48% manganese contains 48 units.
m = meter
m^3 = cubic meter
mt = metric ton = 2,204.6 pounds, 1,000 kilograms
mt/d = metric ton per day
mt/yr = metric ton per year
MW = megawatt
oz = troy ounce
oz/st = troy ounce per short ton
oz/yr = troy ounce per year
% = percent
ppm = part per million
sdt = short dry ton
st = short ton = 2,000 pounds
st/d = short ton per day
st/yr = short ton per year
wk - week
yr = year

THIRD-QUARTER NATIONAL ECONOMIC ACTIVITY AND FOURTH-QUARTER OUTLOOK

By Keith L. Harris[1]

Third-Quarter National Economic Statistics

Buoyed primarily by growing consumer spending, the economy rebounded from a weak second quarter. According to preliminary estimates released by the Department of Commerce, real gross national product (GNP) grew $21.9 billion during the third quarter, producing a seasonally adjusted annual growth rate of 2.4%, compared with a rate of 0.6% in the second quarter of 1986 and 4.1% for the third quarter of 1985 (table 1). Third-quarter real personal consumption expenditures and Government purchases of goods and services rose $42 billion and $7 billion, respectively, but those gains were partially offset by the continuing decline of gross private domestic investment, off $16 billion, and the growing trade deficit, up $11 billion. Three quarters of the growth in consumer spending occurred in the durable goods sector as consumers responded to discounted financing offered by automobile manufacturers attempting to lower inventories of 1986 vehicles. Increased purchases of other durable goods, such as furniture and home furnishings, also contributed to the strength of the durable goods sector. The success of the automobile inventory reduction program as well as weak factory output led to a $20 billion decline in inventory growth. Investment for housing and producers' durable equipment expanded, however, and mitigated some of the impact of slower inventory depending on gross private domestic investment. Capital spending for nonresidential structures declined for the third consecutive quarter.

The declining capital spending and the growing trade deficit continued to be significant and interrelated problems for the economy. Real capital spending for new plants and equipment during 1986 is expected to decline 2.5% after rising 8.7% in 1985 and 15.8% in 1984 (table 2). It is likely that capital expenditures bottomed out in the second quarter and that they will expand in the third and fourth quarters. The first-half decline was partially attributed to uncertainty arising from the pending tax-overhaul bill. Furthermore, there is little impetus for corporations to invest in new capacity since factories are operating at less than 80% of capacity (table 3) largely because of the continuing growth of imports. The growth rate of the trade deficit dropped sharply in the third quarter to less than half that of the previous quarter. Low oil prices, declining automobile and steel imports, and increased exports of agricultural goods contributed to this decline. The continued low growth of the economy caused the Federal Reserve System to reduce the discount rate for the fourth time this year (in late August), dropping it to 5.5%, the lowest level in about 9 years. Inflation, as measured by the fixed-weighted GNP price index, continues to remain low, but rose from the revised second-quarter level of 1.7% to 2.5%, mostly because of rising food costs.

Most of the economic expansion over the past 47 months has been driven by growing personal consumption expenditures and residential fixed investment. Increased employment has accounted for most of the increase in personal consumption expenditures. The rate of growth in employment may be moderating, however. The nonagricultural employment growth rate declined in August and September (table 4), and the civilian unemployment rate increased in September for the first time in 3 months. Jobs in the service-producing industries, which have been growing by more than 200,000 per month and have been contributors to rising employment, grew by only 139,000 in August and 150,000 in September. Housing, another key area of growth for the economy, is also

---

[1] Physical scientist, Office of Special Projects, Bureau of Mines, Washington, DC.

Table 1.—NATIONAL ECONOMIC STATISTICS[1]

	1983	1984	1985	1985		1986		
				III	IV	I	II^r	III^p
Billion current dollars, except as noted								
Gross national product	3,405.7	3,765.0	3,998.1	4,030.5	4,087.7	4,149.2	4,175.6	4,234.3
Percent change from previous period[2]	7.6	10.5	6.2	6.8	5.8	6.2	2.6	5.7
Fixed-weighted price index for GNP[3]	104.1	108.3	112.3	112.6	113.7	114.4	114.9	115.6
Percent change from previous period[2]	4.1	4.0	3.7	2.8	4.0	2.5	1.7	2.5
Personal consumption expenditures	2,234.5	2,428.2	2,600.5	2,627.1	2,667.9	2,697.9	2,732.0	2,799.3
Durable goods	289.1	331.2	359.3	373.3	362.0	360.8	373.9	410.2
Nondurable goods	816.7	870.1	905.1	907.4	922.6	929.7	928.4	935.5
Services	1,128.7	1,227.0	1,336.1	1,346.4	1,383.2	1,407.4	1,429.8	1,453.6
Gross private domestic investment	502.3	662.1	661.1	657.4	669.5	708.3	687.3	674.7
Fixed investment	509.4	598.0	650.0	654.3	672.6	664.4	672.8	682.3
Change in business inventories	-7.1	64.1	11.1	3.1	-3.1	43.8	14.5	-7.5
Net exports of goods and services	-6.1	-58.7	-78.9	-83.7	-105.3	-93.7	-104.5	-110.1
Exports	352.5	382.7	369.8	362.3	368.2	374.8	363.0	373.5
Imports	358.7	441.4	448.6	446.0	473.6	468.5	467.5	483.7
Government purchases of goods and services	675.0	733.4	815.4	829.7	855.6	836.7	860.8	870.4
Federal	283.5	311.3	354.1	360.9	380.9	355.7	367.6	365.7
State and local	391.5	422.2	461.3	468.8	474.4	480.9	493.3	504.7
Final sales (GNP less change in business inventories)	3,412.8	3,700.9	3,987.0	4,027.4	4,090.8	4,105.4	4,161.2	4,241.8
Corporate profits[4]	196.7	230.2	222.6	235.3	226.4	240.8	241.9	NA
Domestic industries	166.6	199.2	190.8	205.3	191.3	202.4	208.9	NA
Manufacturing	70.1	87.4	73.0	79.0	74.5	67.1	77.6	NA
Primary metal industries	-4.9	-2.6	-3.6	-2.6	-3.6	-2.6	-1.1	NA
Fabricated metal products	3.0	4.6	4.1	4.5	3.0	4.7	5.0	NA
Chemicals and allied products	6.7	7.5	4.7	5.3	2.8	6.4	6.7	NA
Petroleum and coal products	21.4	17.3	13.4	17.0	18.7	7.4	9.9	NA
Rest of the world	30.2	31.0	31.8	30.0	35.1	38.4	32.9	NA
Billion 1982 dollars, except as noted								
Gross national product	3,279.1	3,489.9	3,585.2	3,603.8	3,622.3	3,655.9	3,661.4	3,683.3
Percent change from previous period[2]	3.6	6.4	2.7	4.1	2.1	3.8	.6	2.4
Personal consumption expenditures	2,146.0	2,246.3	2,324.5	2,342.0	2,351.7	2,372.7	2,408.4	2,450.4
Durable goods	283.1	318.9	343.9	357.4	347.0	345.4	357.1	387.3
Nondurable goods	800.2	828.6	841.6	843.8	847.2	860.6	877.3	879.1
Services	1,062.7	1,098.7	1,139.0	1,140.8	1,157.5	1,166.6	1,174.0	1,184.0
Gross private domestic investment	504.0	652.0	647.7	643.8	653.2	684.0	664.7	648.6
Fixed investment	510.4	592.8	638.6	643.1	658.4	644.1	649.6	653.2
Change in business inventories	-6.4	59.2	9.0	0.7	-5.2	39.9	15.1	-4.5
Net exports of goods and services	-19.9	-83.6	-108.2	-113.8	-132.0	-125.9	-153.9	-164.6
Exports	348.1	369.7	362.3	355.8	362.9	369.2	359.8	372.9
Imports	368.1	453.2	470.5	469.6	494.8	495.1	513.6	537.5
Government purchases of goods and services	649.0	675.2	721.2	731.8	749.4	725.2	742.2	748.8
Federal	275.1	291.7	323.6	329.9	347.2	320.4	328.9	329.3
State and local	373.9	383.5	397.6	401.9	402.2	404.8	413.3	419.5
Final sales (GNP less change in business inventories)	3,285.5	3,430.7	3,576.2	3,603.1	3,627.5	3,616.1	3,646.3	3,687.8

NA Not available. p Preliminary. r Revised.

[1] Quarterly data are expressed at seasonally adjusted annual rates.

[2] Changes are based on unrounded data and so may differ slightly from changes computed from data shown here.

[3] 1982 weights, 1982 = 100.

[4] With inventory valuation adjustment and without capital consumption adjustment.

Source: U.S. Department of Commerce. News. Sept. 18, 1986, tables 1, 2, 3, and 5; and private communication, Oct. 22, 1986.

Table 2.—NEW PLANT AND EQUIPMENT EXPENDITURES BY BUSINESS[1]

(Quarters seasonally adjusted at annual rates)

	1984	1985[r]	1986[2]	1985 I	1985 II	1985 III	1985 IV	1986 I	1986 II[2]	1986 III[2]	1986 IV[2]
Billion current dollars											
All industry	354.44	387.13	372.59	373.56	387.86	389.23	397.88	377.94	375.92	380.52	383.99
Manufacturing	138.82	153.48	144.01	146.94	154.25	154.47	158.26	144.03	141.68	142.72	147.60
Durable goods	66.24	73.27	68.23	70.29	74.34	72.99	75.47	68.01	68.33	66.30	70.28
Primary metals	7.15	7.75	7.49	7.62	7.56	7.73	8.09	7.81	6.96	7.49	7.69
Blast furnaces	3.54	4.12	3.69	3.93	3.98	4.12	4.46	3.88	2.91	3.99	3.97
Nonferrous metals	2.13	1.88	1.92	2.00	1.83	1.83	1.84	1.86	2.02	1.81	2.00
Stone, clay, and glass	3.09	3.40	3.17	3.21	3.43	3.57	3.40	3.05	2.78	3.35	3.51
Nondurable goods	72.58	80.21	75.78	76.64	79.91	81.48	82.79	76.02	73.35	76.43	77.32
Chemicals	15.32	16.44	17.29	16.32	16.83	16.40	16.23	15.88	16.72	18.24	18.30
Nonmanufacturing	215.61	233.65	235.58	226.62	223.61	234.76	239.61	233.90	234.24	237.79	236.39
Mining	16.86	15.88	11.29	15.81	16.56	15.89	15.25	12.99	11.23	10.80	10.16
Billion 1982 dollars											
All industry	355.41	386.32	376.47	371.84	387.31	388.58	397.57	374.18	372.30	377.71	381.69
Manufacturing	143.58	158.07	146.97	150.98	159.11	159.25	162.95	147.21	144.37	145.72	150.60
Durable goods	65.80	72.73	68.33	69.43	73.78	72.50	75.22	67.37	68.52	66.62	70.84
Primary metals	6.97	7.51	NA	7.37	7.33	7.49	7.85	7.53	6.78	NA	NA
Blast furnaces	3.45	4.00	NA	3.81	3.87	4.00	4.34	3.75	2.85	NA	NA
Nonferrous metals	2.06	1.80	NA	1.92	1.76	1.76	1.77	1.78	1.94	NA	NA
Stone, clay, and glass	3.04	3.32	NA	3.13	3.35	3.48	3.31	2.95	2.70	NA	NA
Nondurable goods	77.78	85.34	78.64	81.55	85.32	86.75	87.74	79.84	75.85	79.10	79.76
Chemicals	15.41	16.45	NA	16.29	16.84	16.42	16.27	15.80	16.76	NA	NA
Nonmanufacturing	211.83	228.25	229.50	220.86	228.20	229.32	234.62	226.97	227.94	231.99	231.09
Mining	20.19	18.93	12.69	18.89	19.86	18.98	17.99	15.19	12.57	11.92	11.09

NA Not available. r Revised.

1 Data reflect revised seasonal-adjustment factors for 1983 through 1986.

2 Estimates are based on planned capital expenditures reported by business in late July and August 1986.

Source: U.S. Department of Commerce. News. Sept. 11, 1986, tables 2 and 3.

Table 3.—CAPACITY UTILIZATION[1]

(Percent, seasonally adjusted)

	TOTAL INDUSTRY	MANUFACTURING: Total manufacturing	MANUFACTURING: Clay, glass, stone	MANUFACTURING: Primary metals: Total primary metals	MANUFACTURING: Primary metals: Iron and steel	MANUFACTURING: Primary metals: Nonferrous	MANUFACTURING: Chemicals, chemical products	MINING	INDUSTRIAL MATERIALS: Total industrial materials	INDUSTRIAL MATERIALS: Metal materials: Total metal materials	INDUSTRIAL MATERIALS: Metal materials: Raw steel	INDUSTRIAL MATERIALS: Metal materials: Aluminum
1982	72.1	70.3	65.1	54.2	47.8	65.8	68.5	83.4	71.7	52.8	49.6	65.9
1983	74.7	74.0	72.2	62.0	57.6	69.9	73.4	77.9	75.3	59.4	58.7	67.6
1984	81.0	80.5	81.3	72.2	67.2	80.4	76.7	84.0	82.0	69.3	67.8	83.2
1985	80.4	80.1	80.9	72.5	67.4	80.6	78.5	82.1	80.2	69.5	67.7	73.0
1985:												
Apr	80.5	80.4	81.8	71.6	66.5	79.8	78.5	82.8	80.5	69.1	67.7	74.0
May	80.5	80.3	81.4	69.3	63.1	79.1	78.5	82.7	80.1	67.2	67.7	73.7
June	80.4	80.0	81.7	70.9	65.6	79.4	78.3	83.5	80.2	69.7	67.6	73.4
July	80.1	79.9	81.6	70.6	64.9	79.9	78.4	81.2	79.7	67.0	68.1	73.5
Aug	80.6	80.3	81.3	74.2	69.3	81.9	78.7	81.6	79.8	70.2	71.1	72.8
Sept	80.3	80.0	81.8	72.8	67.6	81.2	79.3	81.7	79.5	69.1	69.4	71.7
Oct	79.7	79.4	80.8	74.0	69.7	80.8	78.0	80.7	79.1	70.4	69.3	70.4
Nov	80.3	80.1	81.0	74.9	71.2	80.8	78.4	80.7	79.4	72.3	67.9	68.0
Dec	80.6	80.2	81.9	73.9	69.1	81.4	78.3	81.1	80.3	71.8	63.3	67.1
1986:												
Jan	80.9	80.8	83.0	74.7	69.9	82.2	80.3	81.6	80.1	71.0	72.4	68.6
Feb	80.2	80.2	82.5	72.9	67.5	81.4	80.4	79.4	79.6	69.0	70.2	69.8
Mar	79.0	79.1	82.6	69.3	62.6	79.7	79.1	77.9	78.5	66.0	67.7	71.3
Apr	79.5	79.9	83.6	71.0	64.0	81.9	80.5	76.4	78.7	68.3	68.8	72.1
May	79.1	79.4	82.4	68.1	58.9	82.5	79.6	75.5	78.1	65.2	64.9	72.4
June	79.0	79.3	82.7	65.1	57.1	77.6	81.1	74.9	78.0	63.2	63.2	64.7
July	79.3	79.8	81.7	67.1	60.4	77.5	81.3	73.5	78.3	63.8	63.5	61.4
Aug	79.2	79.7	81.7	66.4	59.1	77.6	81.4	73.1	78.1	63.4	58.9	64.2
Sept	79.2	79.8	NA	66.5	NA	NA	NA	72.9	78.0	63.9	NA	NA

NA Not available. 1 Data have been revised back through 1984.

Source: Federal Reserve Statistical Release. G.3 (402), Capacity Utilization, Oct. 17, 1986, tables 1 and 3.

Table 4.—EMPLOYEES ON NONAGRICULTURAL PAYROLLS
(Thousand workers; months seasonally adjusted at annual rates unless otherwise noted)

	TOTAL NONAGRICULTURAL EMPLOYMENT	MANUFACTURING						MINING				
				Primary metals					Metal mining			
		Total manufacturing	Clay, glass, stone	Total primary metals	Iron and steel	Nonferrous[1]	Chemicals, chemical products	Total mining	Total metal mining[1]	Iron ore[1]	Copper ore[1]	Nonmetallic minerals[1]
1982.....	89,566	18,781	576.9	921.9	396.2	55.5	1,075.1	1,128	72.9	13.2	24.3	109.7
1983.....	90,200	18,434	570.0	831.8	340.8	49.8	1,042.8	952	56.4	10.3	18.9	104.3
1984.....	94,496	19,378	592.6	857.4	334.1	51.4	1,049.4	966	55.1	11.4	16.3	108.5
1985.....	97,614	19,314	590.6	812.8	304.9	45.5	1,045.8	930	46.8	9.8	13.4	110.5
1985:												
Apr...	97,104	19,356	590	821	309	46.9	1,052	949	48.5	10.9	13.8	109.8
May...	97,338	19,323	590	818	308	46.3	1,048	944	48.1	11.0	13.6	114.5
June..	97,442	19,290	589	814	307	45.5	1,046	936	48.0	11.0	13.4	116.4
July..	97,672	19,268	589	807	305	45.0	1,045	928	46.4	9.4	13.3	116.8
Aug...	97,890	19,256	591	798	302	44.1	1,043	922	46.3	10.5	13.2	116.1
Sept..	98,128	19,198	590	795	304	43.9	1,042	917	45.1	9.3	12.8	115.8
Oct...	98,428	19,236	591	797	304	43.7	1,040	913	44.6	9.2	13.0	114.6
Nov...	98,666	19,259	591	801	302	42.4	1,037	907	45.1	9.6	13.1	112.6
Dec...	98,910	19,289	593	803	303	41.8	1,035	901	43.8	8.0	13.5	106.5
1986:												
Jan...	99,296	19,303	596	798	300	42.3	1,034	897	44.6	8.8	13.7	100.3
Feb...	99,429	19,294	597	795	299	41.7	1,032	880	43.9	8.8	12.9	100.4
Mar...	99,484	19,255	594	787	293	41.7	1,031	852	43.9	8.8	13.2	104.2
Apr...	99,783	19,245	600	785	291	41.7	1,028	821	43.9	9.7	12.1	110.8
May...	99,918	19,201	599	780	288	41.3	1,024	790	43.5	9.7	12.2	113.7
June..	99,843	19,135	597	761	286	36.4	1,026	772	42.9	9.5	12.1	114.5
July..	100,105	19,121	593	758	285	36.2	1,025	768	42.9	9.7	12.0	114.7
Aug...	100,261	19,122	593	742	265	36.9	1,026	752	40.2	7.6	12.0	114.7
Sept..	100,368	19,084	595	741	264	NA	1,025	745	NA	NA	NA	NA

NA Not available. 1 Not seasonally adjusted.

Source: Bureau of Labor Statistics. Employment and Earnings. Various issues.

Table 5.--SELECTED INDEXES OF INDUSTRIAL PRODUCTION[1]
(Seasonally adjusted, 1977 = 100.0)

	TOTAL INDUSTRIAL PRODUCTION	MANUFACTURING						MINING						
				Primary metals					Metal mining					
		Total manufacturing	Clay, glass, stone	Total primary metals	Iron and steel	Nonferrous	Chemicals, chemical products	Total mining	Total metal mining	Iron ore	Copper ore	Nonmetallic minerals	Coal	Oil and gas
1982.....	103.1	102.2	89.2	65.8	57.5	80.5	103.8	109.3	71.4	66.4	82.6	95.1	119.9	110.9
1983.....	109.2	110.2	99.1	73.0	66.1	87.9	114.0	102.9	65.2	68.8	75.9	106.1	113.3	102.8
1984.....	121.4	123.4	113.4	82.3	73.4	99.3	121.6	111.1	77.0	92.1	73.6	117.4	128.1	109.1
1985.....	123.8	126.4	115.5	80.5	70.4	99.7	127.1	108.3	75.0	87.7	79.4	118.3	126.8	106.2
1985:														
Apr...	123.3	126.1	116.1	79.8	69.8	98.7	126.7	109.7	78.5	92.8	79.1	119.3	130.1	106.3
May...	123.6	126.3	115.8	77.1	66.1	97.8	126.9	109.5	77.3	99.5	79.8	118.6	128.5	106.7
June..	123.6	126.1	116.5	78.9	68.7	98.2	126.8	110.6	77.7	93.1	78.1	118.0	136.3	106.4
July..	123.4	126.3	116.6	78.5	67.7	98.8	127.2	107.5	67.1	56.4	81.0	117.9	124.0	106.0
Aug...	124.4	127.2	116.4	82.3	72.3	101.3	127.9	108.1	74.9	94.2	73.2	118.1	125.0	105.7
Sept..	124.3	127.0	117.4	80.8	70.3	100.4	129.1	108.2	73.8	96.7	74.4	118.8	126.9	105.4
Oct...	123.6	126.3	116.1	81.9	72.4	100.0	127.3	106.9	76.0	94.7	76.9	118.5	122.9	104.4
Nov...	124.8	127.8	116.7	82.9	73.9	100.0	128.2	106.9	78.3	102.4	77.1	118.0	125.8	103.6
Dec...	125.6	128.2	118.2	81.7	71.6	100.8	128.1	107.4	77.3	74.2	88.3	114.6	128.4	104.2
1986:														
Jan...	126.2	129.4	120.0	82.4	72.2	101.8	131.7	108.1	73.5	76.7	84.5	113.5	130.8	104.9
Feb...	125.3	128.7	119.3	80.3	69.5	100.8	132.0	105.1	77.2	83.8	81.6	116.8	126.5	101.1
Mar...	123.6	127.2	120.0	76.3	64.3	93.8	130.2	103.0	75.9	82.0	80.5	111.6	124.7	99.2
Apr...	124.7	128.7	121.6	78.1	65.6	101.6	132.8	101.0	76.0	82.7	80.6	115.0	124.4	96.7
May...	124.2	128.2	120.2	74.8	60.2	102.3	131.5	99.8	72.0	84.3	NA	112.4	124.0	95.1
June..	124.2	128.3	120.8	71.4	58.3	96.3	134.2	98.9	65.9	56.0	NA	114.5	127.3	93.3
July..	124.9	129.3	119.6	73.5	61.4	96.2	134.8	97.1	NA	NA	NA	111.8	120.2	92.3
Aug...	125.1	129.4	119.8	72.6	59.9	96.5	135.1	96.5	NA	NA	NA	114.8	122.2	90.8
Sept..	125.3	129.8	NA	72.6	NA	NA	NA	96.1	NA	NA	NA	NA	NA	90.3

NA Not available. 1 Data have been revised back through 1984.

Source: Federal Reserve Board. Statistical Release G.12.3, Industrial Production. Oct. 16, 1986, tables 1A, 2A, and 4A.

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losing steam, despite declining low mortgage interest rates. Housing starts for September dropped 7.6% from the August level to reach 1,680,000, the lowest level since November 1985; new home sales dropped 13.4% during August to their lowest level since August 1984. Construction employment rose 32,000 in August but only 2,000 in September.

Mining and manufacturing employment continued to decline as the industrial sector of the economy continued its sluggish growth. The Federal Reserve Board industrial production index rose 0.2 percentage points in both August and September, returning to a level reached last February (table 5). Manufacturing output was up, but mining output continued to decline. Industrial capacity utilization rates remained largely unchanged since May, holding steady at 1 percentage point below those of May 1985. Manufacturing capacity utilization returned to 79.8% in September after a slight decline in August, but mining declined for the eighth consecutive month.

Fourth-Quarter Prognosis

The index of leading indicators for August declined 0.2% following a revised increase of 1% in July and a revised drop of 0.2% in June. The index has declined for 3 of the past 4 months. As reflected by the weak performance of the index of leading indicators and the declining employment rates in the service sector and lack of stronger growth in the industrial sector, the economy is expected to continue its relatively modest performance in the fourth quarter.

THE MINERAL POSITION OF THE UNITED STATES: THE PAST FIFTEEN YEARS *

SUMMARY

The Mining and Minerals Policy Act, enacted by the Congress in 1970, requires the Secretary of the Interior to report annually on the mineral position of the United States. The current report reviews the changes that have taken place in the Nation's mineral position from the time of the act's passage to the present. These changes have been dramatic and of no small consequence to the United States and the rest of the world. The domestic market for many mineral raw materials, especially the basic metals, generally grew more slowly than the rest of the economy and, in some instances, the market even declined. The reasons for the changes are technical as well as economic. Substitute materials, initially plastics but more recently ceramics and composites, have made inroads into traditional metal markets such as construction, transportation, and communication. New technologies often lead to the use of less mineral materials than older technologies. Spending for construction projects such as roads, bridges, homes, and factories declined as a percent of GNP in the 1970's compared with preceding decades, thereby slowing the demand for sand and gravel, cement, glass, iron and steel, copper, and aluminum. At the same time that growth in domestic demand slowed, many producers of raw and processed mineral materials became less competitive with foreign operations, some of which are owned or partly owned by U.S. firms.

Availability of competing materials, declining intensity of use, severe buffeting by unfavorable economic conditions, and even foreign competition are not new to the minerals industry. Such conditions have prevailed in the past, yet the industry continued to thrive. In the last 15 years, however, minerals and mineral-based products produced abroad captured larger shares of world markets, while the share of these markets supplied by U.S. mines and plants steadily eroded. The high cost of domestic labor, burdensome environmental costs, declining quality and quantity of domestic ore deposits, rapid diffusion of new mining and processing technologies around the world, and the policies of many foreign governments to encourage expanded production despite unfavorable market conditions contributed to the change. In the last 5 years, the strength of the U.S. dollar relative to foreign currencies made the U.S. trade position in minerals deteriorate still further.

Declining demand for minerals, along with the competition posed by low cost products from foreign sources, has forced the industry to cut back production, cancel expansion plans, lay off workers, and reduce investment. Despite these measures, excess production caused prices to fall and profits to become small or negative. Over the last 15 years, the mineral industry grew at a slower pace than the rest of the economy during business expansions and declined more precipitously during recessions. However, during the last 2 years, the corrective measures implemented by industry and Government have brought some improvement.

Although the conditions described above characterize the position of the U.S. mineral industry in general, the metal producing sectors have been particularly hard hit. Metals have been most vulnerable to substitution. New technology has had the greatest impact on metal demand, usually by requiring less of the basic metals.

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* Excerpted from the 1985 Annual Report of the Secretary of the Interior under the Mining and Minerals Policy Act of 1970. A limited supply of copies are available on request from the Bureau of Mines, Division of Publications, 4900 La Salle Road, Avondale, MD 20782-3393.

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Environmental and energy conservation regulations also have played a role in reducing the demand for certain metals. Low ore grades, environmental costs, and declining capital investment have hit the metal sector of the mineral industry selectively by increasing the cost of production, and metals producers have borne most of the burden of foreign competition.

Although the performance of the mineral industry from 1971 through 1985 has been poor, the outlook for the future is brighter. Private sector initiatives, encouraged in part by Government policies, are resulting in more efficient, more diversified firms. Both prices and profits, although still low by previous standards, have firmed as productivity gains are realized. As inflation and interest rates continue to subside, new construction, a major consumer of minerals, should increase. As technology advances, demand patterns will continue to change, but mineral materials, including metals, will compete more effectively for markets. Voluntarily negotiated restraints on some exports to the United States, the declining value of the dollar relative to that of foreign currencies, and increased productivity will result in a more competitive domestic industry.

An industrial society such as the United States depends upon a wide variety of mineral materials, available from secure sources at the lowest reasonable cost. U.S. producers, within the environment of fair competition, without unnecessary Government regulations, and with entrepreneurial and technological innovation will continue to serve the vital needs of the Nation and will compete effectively in world markets.

OUTLOOK FOR NONFUEL MINERALS

The U.S. mineral industry is undergoing significant structural change. Although the importance of mineral production relative to the national product of the United States probably will continue to decline, the absolute importance of minerals in our economy will remain strong. The relative intensity of use in the United States--the amount of mineral materials needed per unit of output--has decreased significantly, perhaps as much as 45% in the past 15 years for steel, with another decrease of 30% likely by the year 2000. In a high-technology economy, less of the basic metals are needed, although the need for construction materials to build new infrastructure and maintain roads, bridges, and buildings is expected to increase.

Demand and Supply

Despite continued population growth, demand for minerals, particularly for the internationally traded metals, will grow only moderately. Shifts in demand patterns caused by the continuing decline in the intensity of use of the basic metals and increased substitution of plastics, nonmetal composite fibers, ceramics, and other nonmetallic materials are likely to result in more innovative use of traditional materials and increased marketing efforts by their producers. The long-expected increase in demand for minerals as a result of growth in developing-country economies has not occurred and may never take place to the extent once predicted because these economies may not duplicate the industrial and social growth patterns experienced by the western industrial countries.

The outlook for growth in demand is better for the nonmetallic minerals than for basic metals, but the growth in demand for advanced metals or rare-earth metals could be considerable. While the quantitative use of these metals will remain modest, and cannot compensate for the economic effect of lower growth in the basic metals, there will be opportunities for firms to diversify into specialty metal and material production.

The outlook for secure and dependable mineral supplies is generally favorable. For many commodities, the world reserve ratio--the ratio of identified economic resources to the current volume of production--has increased significantly since 1950. In other words, because of new discoveries, reserves of certain minerals are growing at a faster pace than cumulative production despite the fact that current production of these minerals is two to three times the production rate of 35 years ago.

There are, however, continued concerns about the vulnerability of the United States and other western industrial countries to disruptions in the supply of strategic and critical minerals that are located in politically sensitive areas. Southern Africa, for example, has been of concern because of its dominance as a source of supply for some of these metals. The unsettled situation in Angola, Mozambique, Namibia, and the Republic of South Africa, the relative ease with which vital transportation links can be severed, and the dependence of industrial countries on supplies of chromium, cobalt, manganese, platinum, and vanadium from that region raise an important security-of-supplies issue. This issue requires continued attention by the U.S. Government and recognition of the essential role currently played by this region as a supplier of strategic and critical minerals to the world. The Soviet Union, the world's largest producer of minerals, is not a major and regular supplier to the United States. In 1984, the primary U.S. imports from the Soviet Union were aluminum, platinum group metals, and petroleum products.

Developing countries are likely to be a continuing and growing source of supply for many minerals. These countries rely on earnings from the export of minerals to raise their standard of living, service their debts, and pay for imports of fuel and other goods. Thus, their need to export minerals is not likely to abate in the near future. While the U.S. Government should not support the development of foreign mineral deposits and mineral sectors that compete with domestic industries, it nevertheless should not resist resource development in developing countries, provided such development can be accomplished without subsidies.

The United States promotes diversification of sources of supply for strategic minerals by encouraging private sector investment in the resource development of developing countries. The U.S. foreign assistance program, an essential instrument of foreign policy, should be utilized to reflect the national interest of the U.S. in terms of improved access to key raw materials. Exploration for and development of strategic minerals facilitate economic growth in developing countries and serve the U.S. national interest by assuring access to these minerals.

Two countries that may change the pattern of worldwide demand for and supply of minerals are China and the U.S.S.R. A number of Soviet deposits, primarily in Europe, are being exhausted. If the U.S.S.R. continues with a policy of relative self-sufficiency in minerals, it will have to pay the increased cost of developing, producing, and transporting them from new mines in remote locations in central Asia and Siberia. On the other hand, the U.S.S.R. may seek to purchase at least some of its future mineral needs in world markets. China already has burst upon the world economy both as a major supplier of minerals (tungsten, coal, rare earths) and as a purchaser of metal-intensive equipment. China could be both a major market opportunity for U.S. companies and a formidable competitor in the production of a number of commodities.

The Mineral Position of the United States

In the future, the United States will continue to be among the leaders in world production and consumption of minerals. Its resources of copper, lead, molybdenum, phosphate, sulfur, sand and gravel, and coal are vast. Its plant capacity for producing raw and processed minerals and its labor and management skills will continue to be sufficient to supply many of the needs of the Nation. However, the relative share of U.S. mine production of basic metals and agricultural minerals will continue to decline both as a percentage of world production and as a percentage of domestic GNP. The relative share of processed minerals may increase as U.S. industry develops and markets new materials, finds new uses for "old" materials, develops innovative means for the combined use of metals with fibers, carbon, glass, ceramics, and plastics, and introduces advanced processing technologies. The Bureau of Mines is shifting its program emphasis to help find and accelerate such breakthrough opportunities.

Much of the recent success of U.S. competitors is attributed to the growing strength of the dollar from 1980 through early 1985. Since then, the dollar has declined significantly in international currency markets, and it is not expected to rise significantly in the near future. If fuel costs continue their recent decline, domestic mineral production should be stimulated still further. The major cost reductions and efficiency measures put in place by many companies should allow them to compete more effectively against imports of raw and processed materials.

The U.S. mineral industry will continue to bear a significant portion of the cost of environmental protection. The Department of the Interior is expanding its work on environmental issues and will evaluate proposed regulations that may have a significant impact on mineral producers. For example, a Regulatory Projects Coordination Group has been created in the Bureau of Mines to focus better the Bureau's considerable research and analytical expertise on such proposed regulations as those pertaining to mining waste.

Finally, new technology will play an increasingly important role in the competition for world markets. For example, insitu and heap leaching followed by solvent extraction, a process whereby copper can be extracted from previously uneconomic low-grade copper oxide ores, can reduce capital and operating costs by nearly 50% and has low environmental costs. It has the potential for economic exploitation of small and/or low-grade deposits, including those containing strategic and critical minerals. Leaching and solvent extraction methods currently account for 10% of U.S. copper production, and this figure could more than double in the next 5 years.

New technology also will lead toward a more competitive steel industry. The low costs and aggressive marketing of steel minimill plants--plants that use scrap steel as raw material and produce a limited line of products--have steadily increased their market share, from 3% in 1960 to more than 20% in 1985. Specialty steel plants share many of the economic advantages of minimills. Their products account for about 10% of the industry's sales while producing only 2% of its volume. But the increased use of advanced technologies, such as direct reduction and continuous-feed electric furnaces, ladle technology and thin strip casting, and improved sensors for computer controlled systems, will be needed to restore the health of the industry. Application of advanced technologies in mining and mineral processing also holds promise for breakthroughs to improve productivity and for worker health and safety. Bureau of Mines research is seeking ways to advance base technology through the use of automation, robotics, and computerized mining decision-making systems.

U.S. companies will have to adjust to the increased international competition in other ways as well. They may have to become more multinational with an international division of functions and activities appropriate to the comparative advantages of different countries. Joint ventures with foreign partners, risk sharing arrangements, and diversification will become more common.

THE STATE OF THE MINING INDUSTRY IN THE NORTHWESTERN UNITED STATES AND SUPPORTIVE ACTIVITIES IN THE BUREAU OF MINES[1]

Presented by Robert C. Horton, Director, Bureau of Mines

The trend of the mineral industry in the Northwestern States--Idaho, Montana, Oregon, and Washington--over the years 1981 through 1985 has been a downward one. Low prices for copper, lead, and zinc, and increasingly stringent environmental regulations have forced closure of three major smelters in the region, interrupted copper mining in Butte, MT, and have curtailed lead-zinc-silver mining in the Coeur d'Alene, ID district. Wide fluctuations in silver prices have caused corresponding swings in silver production; currently depressed prices have recently shut down nearly 70% of the region's silver production capacity. Exploration for metals, booming in the late 1970's, has slowed, except for gold deposits. Gold is the sole metallic mineral where production has steadily increased over the 5-year term, and remains the bright spot in exploration. Exploration for and development of nonmetallic mineral deposits have also enjoyed a significant increase in the last 2 years.

While the mining industry in the Northwestern United States has experienced serious setbacks, there have been some positive developments. During 1985, the estimated value of nonfuel mineral production in the State of Washington increased around 11% from the previous year, reaching nearly $225 million. This improvement was attributed to significant increases in the production of diatomite, gold and peat. Increased gold exploration by such companies as United Mining Corporation, Tenneco Minerals Company, Tillicum Gold Mines, Inc., Kerr Addison Mines Ltd., St. Joe Minerals Corporation, and Teck Corporation demonstrated the determination and initiative of our minerals industry. In addition, development at the Gold Hill Mine was begun by Vulcan Mining Company; Hecla Mining Company reported discovery of additional gold reserves at its Knob Hill Mine; and Asamera Minerals (U.S.) Inc.-Breakwater Resources Ltd. partnership began gold production at its Cannon Mine.

While declining metal prices during 1985 continued to affect northwest aluminum producers, Bonneville Power Administration devised a plan linking variable power rates to aluminum prices and offered it to northwest aluminum producers. This is an example of the cooperative effort which we seek to promote between the mining industry and utilities and other companies.

Nonfuel mineral production value in the State of Oregon showed a decrease from 1984 to 1985; however, this was significantly linked to a temporary shutdown at Hanna Mining Company's Riddle nickel operation which took place in order to permit installation of a new $13 million "wet screening " process--a good example of improved technology and innovative use of a new technique to increase efficiency in mining operations and enable production of lower grade ores in a cost-effective manner.

Montana experienced a serious decrease of 10% in the value of nonfuel mineral production in 1985, due largely to decreases in silver and copper production and decreases in the value of gold. However, there was increased exploration activity in the State, with Asarco gaining permission to patent 101 mining claims for silver-copper deposits in the Cabinet Mountains and underground exploration conducted by Midas Gold Inc. at the Gold Coin Mine in the Georgetown district. In addition, industrial minerals production value increased 6% from that of 1984. It is a pleasure to note that copper mining has resumed at Butte. Also, mine development is continuing at the Stillwater Complex platinum-palladium project, with $40 million to be spent on the project and initial production set for 1987. Recent events in South Africa and proposed legislative sanctinos against that country have increased awareness and interest in the Stillwater project.

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[1] Excerpted from hearing testimony presented in Coeur d'Alene, ID, before the United States Senate Committee on Energy and Natural Resources Subcommittee on Natural Resources Development and Production on August 20, 1986.

While Idaho maintains the position as the Nation's top-ranked silver producer, having reached a cumulative production of 1 billion oz of silver from the Coeur d'Alene region last year, recent closings of the Sunshine Mine, Lucky Friday Mine, and Crescent Mine deeply concern many of us. Industrial minerals production value in Idaho increased 9% in 1985, with the largest gains for phosphate rock and portland cement, and several companies are expanding and improving their processing facilities. The Bureau of Mines undertook a study last year to identify the importance of minerals in the Idaho economy, with emphasis on the employment and income that mining and minerals processing generated in the State economy, and copies are available from the Bureau. This study is being updated in light of recent closures.

As the agency charged with the responsibility of collecting and analyzing data on the mining and production of our Nation's minerals, the Bureau of Mines is very much aware of the critical problems facing the domestic mining industry: decreasing ore grades, increasing minerals recovery costs, increased costs of regulatory compliance, high capital costs, and competition from foreign companies which are sometimes subsidized by foreign governments or by multinational development institutions. At the same time, we are aware of increasing U.S. dependency on foreign strategic and critical minerals and materials, and the importance of maintaining a viable domestic industry, both from the standpoint of national defense and our Nation's economy. Consistent with its mandate to represent the concerns of the domestic mining industry, the Bureau of Mines seeks to recognize and encourage those companies which develop and utilize improved technologies to increase their production. Much of the research carried out by the Bureau, often in cooperation with mining companies, takes place through our Spokane (WA) Research Center and at the Idaho National Engineering Laboratory. Before proceeding to describe some of that research, you should be aware that other Department of the Interior bureaus, especially the U.S. Geological Survey, carry on research activities related to mining and minerals industry in the Pacific Northwest.

In order to ensure that the domestic mining industry remains a viable part of our economy, mining and mineral extraction technologies must be improved, costs minimized, and unnecessary regulatory requirements removed. Recognizing this, the Bureau has been actively working with various companies in the Coeur d'Alene area on such problems as ground control, mine backfill, and waste disposal. Our Research Center at Spokane is a world leader in rock mechanics technology and mine fill mechanics technology. Such technologies are very important to mining in Idaho and other areas where mining takes place in deep deposits and in rock subject to high tectonic stress. Older mining methods, such as the overhand stoping method, are subject to disruption caused by rock bursts occurring when stress builds up in the crown pillar above mining operations. Not only do such bursts disrupt the mining operation, but they also can injure or kill, as occurred in April of this year when one miner was killed and two others were injured by a rock burst.

To address this problem, the Bureau, in cooperation with Hecla Mining Company and the University of Idaho, is working to develop and evaluate new mining methods which minimize rock burst dangers. In 1979, the Bureau and Hecla introduced the underhand cut-and-fill mining technique at the Star Mine in northern Idaho. While the scope of that effort was limited to controlling sill pillar bursts, it also established the value of underhand mining as a rock burst deterrent. This technique involves mining of ore and placement of cement fill to provide a quality roof that has little tendency to burst. Key to this system is development of a competent fill that is reasonably inexpensive, can be placed in as dry of a manner as possible, and which can be transported to the mine workings at a reasonable cost.

The Bureau, Hecla Mining Company, and the University of Idaho are involved in the Lucky Friday Underhand Longwall (LFUL) project to test the feasibility of converting the entire mine to this mining method. Laboratory investigations are being conducted to gain a better understanding of the mechanics of rock fracture and bursting, and field measurements of movements and stresses induced by mining are being used to predict rock mass response to the mining and filling sequence. A key part of both the laboratory and field investigations is the identification of acoustical emission patterns which precede rock failure and rock burst incidents. Characteristic patterns are established in the laboratory, and field work correlates these patterns with events in the mine. This project continues today in spite of the closure of the Lucky Friday Mine because the Bureau and Hecla believe that the LFUL concept offers great hope for improving mine safety and efficiency and, hopefully, returning this mine to full production.

The Bureau has also established new techniques and procedures for instrumenting and monitoring rock behavior around mine openings. Of particular importance have been our investigations associated with mine shaft construction of the Silver Shaft at the Lucky Friday Mine and the Caladay Shaft at the Caladay Mine.

Another research effort which the Bureau is carrying out in the Coeur d'Alene area deals with waste disposal and its effect on the environment. While some past mining practices have caused environmental problems, it is incorrect and unfair to presuppose that any mining activity automatically is related to environmental degradation. On the contrary, many companies have shown a strong interest in the development and testing of techniques for waste use, treatment, and disposal in an efficient and cost-effective manner. The Bureau has been working on developing and evaluating methods of safely disposing of waste in a manner that would meet water quality requirements and be physically and chemically stable. In one study, a prototype waste structure was built using reslurried tailings, transported and placed on a river floodplain. The site was monitored to evaluate the effectiveness of the waste disposal concept and the influence this disposal had on water quality. Results indicated that tailings could be safely placed in the flood plain and that water quality of the seepage water would meet current requirements. This would eliminate a need for lining the pond--a very expensive requirement. Also, sites developed in this manner could be utilized for other purposes, since the soil-bearing capacities are adequate for building construction. The Bureau has also been investigating methods to duplicate the mechanisms promoting leaching activities associated with heavy metal waste problems. Hopefully, an understanding of these mechanisms will enable us to develop methods to control such waste problems.

Research is also being carried out at the Idaho National Engineering Laboratory (INEL) with the support of the Bureau of Mines. The Bureau's research program on strategic and critical minerals seeks to (1) discover entirely new methods to produce certain strategic metals from low-grade domestic resources, and (2) develop methods to reduce the usage of critical materials through acceleration of replacement with substitute materials containing lesser amounts of critical materials, or none at all. INEL is presently involved with production technologies applicable to cobalt. The first method under study is improving the use of bacteria to accelerate leaching and to concentrate metal ions in the leachate through genetic engineering and bioenhancement. The second method under study is the use of thermal plasmas (electric arcs) to accelerate chemical reactions, thereby dramatically improving the process economics. Two types of materials which offer promise as substitutes for alloy steel are ceramics and rapidly solidified alloys. Since existing technology does not permit fabrication of composite shapes made from either materials, another INEL research project is aimed at discovering joining methods which will enable complicated shapes to be fabricated. The laboratory is alos conducting research into intermatallic compounds which can replace platinum catalysts.

Over the past year, the Bureau has developed a team of individuals and a process for interacting with the Environmental Protection Agency (EPA) on mining issues, so as to interject appropriate data and resources early in the process of regulatory review. In December 1985, EPA published a report to Congress on mine waste, as required by the Resource Conservation and Recovery Act, which was to serve as a basis for formulating regulations. The Bureau raised a number of concerns regarding the report and offered several recommendations. EPA generally concurred with the Bureau's recommendations, and the two agencies will continue to work together on mine waste and related environmental issues.

Another example of the Bureau's cooperative efforts with EPA took place in Idaho recently, when research personnel from the Spokane Research Center met with EPA Solid Waste Division staff to discuss utilization of Bureau-developed mine backfill technologies as a possible means to dispose of soil from the Bunker Hill area in abandoned underground mine voids.

The Bureau constantly strives to work with industry, with Congress and with other agencies of the Federal Government to promote effective, cost-efficient, and nationally needed development of our country's mineral resources. The Bureau welcomes your comments, cooperation, and interaction at all times.

FEMA'S STOCKPILE GOALS AND INVENTORIES AS OF JUNE 30, 1986

(Report released to the public in late September)

	Goal		Inventory
Aluminum metal group:			
Alumina	0		0
Aluminum	700,000	st	2,080
Bauxite, metal-grade, Jamaica-type	21,000,000	ldt	12,457,740
Bauxite, metal-grade, Surinam-type	6,100,000	ldt	5,299,597
Aluminum oxide, abrasive grain group:			
Aluminum oxide, abrasive grain	0	st grain	50,904[1]
Aluminum oxide, fused, crude	0	st	249,867[1]
Bauxite, abrasive grain	1,000,000	lct	0
Antimony	36,000	st	37,851
Asbestos, amosite	17,000	st	34,011
Asbestos, chrysotile	3,000	st	10,751
Bauxite, refractory	1,400,000	lct	199,926
Beryllium metal group:			
Beryl ore, 11% BeO	18,000	st	17,987
Beryllium copper master alloy	7,900	st	7,387
Beryllium metal	400	st	290
Bismuth	2,200,000	lb	2,081,298
Cadmium	11,700,000	lb	6,328,809
Chromium, chemical and metallurgical group:			
Chromite, chemical-grade ore	675,000	sdt	242,414
Chromite, metallurgical-grade ore	3,200,000	sdt	2,132,610[2]
Chromium, ferro, high-carbon	185,000	st	502,409[2]
Chromium, ferro, low-carbon	75,000	st	318,942[2]
Chromium, ferro, silicon	90,000	st	58,357[2]
Chromium, metal	20,000	st	3,763[2]
Chromite, refractory-grade ore	850,000	sdt	391,414
Cobalt	85,400,000	lb Co	53,109,188
Columbium group:			
Columbium carbide powder	100,000	lb Cb	21,372
Columbium concentrates	5,600,000	lb Cb	2,019,218[3]
Columbium, ferro	0	lb Cb	930,911[3]
Columbium, metal	0	lb Cb	44,851[3]
Copper	1,000,000	st	29,048[4]
Cordage fibers, abaca	155,000,000	lb	0
Cordage fibers, sisal	60,000,000	lb	0
Diamond, industrial group:			
Diamond dies, small	60,000	pc	25,473
Diamond, industrial, crushing bort	22,000,000	kt	22,001,344
Diamond, industrial, stones	7,700,000	kt	11,966,573
Fluorspar, acid-grade	1,400,000	sdt	895,983
Fluorspar, metallurgical-grade	1,700,000	sdt	411,738
Germanium	30,000	kg	0
Graphite, natural - Ceylon, amorphous lump	6,300	st	5,497
Graphite, natural - Malagasy, crystalline	20,000	st	17,838
Graphite, natural - other than Ceylon and Malagasy	2,800	st	2,803
Iodine	5,800,000	lb	7,372,081
Jewel bearings	120,000,000	pc	74,424,068

Lead	1,100,000	st	601,018
Manganese dioxide, battery-grade group:			
Manganese, battery-grade, natural ore	62,000	sdt	211,768
Manganese, battery-grade, synthetic dioxide	25,000	sdt	3,011
Manganese, chemical and metallurgical group:			
Manganese ore, chemical-grade	170,000	sdt	173,275
Manganese ore, metallurgical-grade	2,700,000	sdt	3,255,144
Manganese, ferro, high-carbon	439,000	st	670,892
Manganese, ferro, low-carbon	0		0
Manganese, ferro, medium-carbon	0	st	29,057
Manganese, ferro, silicon	0	st	23,574
Manganese, metal, electrolytic	0	st	14,172
Mercury	10,500	fl	169,226
Mica, muscovite, block, stained and better	6,200,000	lb	5,212,361
Mica, muscovite film, 1st and 2d qualities	90,000	lb	1,178,755
Mica, muscovite splittings	12,630,000	lb	14,781,751
Mica, phlogopite block	210,000	lb	130,745
Mica, phlogopite splittings	930,000	lb	1,521,152
Molybdenum group:			
Molybdenum disulphide	0		0
Molybdenum, ferro	0		0
Morphine sulphate and related analgesics:			
Crude	0	ama lb	31,795
Refined	130,000	ama lb	39,508
Natural insulation fibers	1,500,000	lb	0
Nickel	200,000	st Ni+Co	37,222
Platinum group metals, iridium	98,000	tr oz	29,590
Platinum group metals, palladium	3,000,000	tr oz	1,264,602
Platinum group metals, platinum	1,310,000	tr oz	452,641
Pyrethrum	500,000	lb	0
Quartz crystals	600,000	lb	1,848,532
Quinidine	10,100,000	av oz	2,473,199
Quinine	4,500,000	av oz	3,246,164
Ricinoleic and/or sebacic acid products	8,800,000	lb	5,009,697
Rubber	850,000	mt	125,432
Rutile	106,000	sdt	39,186
Sapphire and ruby	0	kt	16,305,502
Silicon carbide, crude	29,000	st	80,550
Silver (fine)	0	tr oz	136,005,707
Talc, steatite, block and lump	28	st	1,081
Tantalum group:			
Tantalum carbide powder	0	lb Ta	28,688
Tantalum metal powder	0	lb Ta	201,133
Tantalum minerals	8,400,000	lb Ta	2,837,943
Thorium nitrate	600,000	lb	7,121,812
Tin	42,674	mt	182,421
Titanium	195,000	st	36,831
Tungsten group:			
Tungsten carbide powder	2,000,000	lb W	2,032,942
Tungsten, ferro	0	lb W	2,025,361
Tungsten metal powder	1,600,000	lb W	1,898,831
Tungsten ores and concentrates	55,450,000	lb W	80,252,565

Vanadium group:			
Vanadium, ferro	1,000	st V	0
Vanadium pentoxide	7,700	st V	721
Vegetable tannin extract, chestnut	5,000	lt	12,863
Vegetable tannin extract, quebracho	28,000	lt	128,690
Vegetable tannin extract, wattle	15,000	lt	15,099
Zinc	1,425,000	st	378,316

Abbreviations

ama lb — anhydrous morphine alkaloid (pounds)
av oz — avoirdupois ounce
fl — flask (76-pound)
kt — carat
lb — pound
lb Co — pounds of contained cobalt
lb Cb — pounds of contained columbium
lb Mo — pounds of contained molybdenum
lb Ta — pounds of contained tantalum
lb W — pounds of contained tungsten
lct — long calcined ton
ldt — long dry ton
lt — long ton
mt — metric ton
pc — piece
sdt — short dry ton
st — short ton
st Ni+Co — short tons of contained nickel plus cobalt
st V — short tons of contained vanadium
tr oz — troy ounce

Footnotes

1 Hold 50,904 st aluminum oxide abrasive grain and 249,867 st aluminum oxide fused crude as offset against 379,253 lct of the bauxite abrasive grade objective.

2 Hold 317,409 st chromium-ferro high carbon as offset against 793,523 sdt of the chromite metallurgical grade ore objective. Hold 199,748 st chromium-ferro low carbon against 499,371 sdt of the chromite metallurgical grade ore objective. Hold 47,465 sdt nonspecification chromite metallurgical grade ore as offset against the 31,643 st chromium ferrosilicon objective. Hold 56,773 sdt of nonspecification chromium metallurgical grade ore as offset against the 16,237 st chromium metal objective. The remaining 152,314 sdt of nonspecification chromite metallurgical grade ore held as offset against 152,314 sdt of the chromite chemical-grade ore objective.

3 Hold 930,911 lb columbium ferro as offset against 1,095,189 lb of the columbium concentrate objective. Hold 44,851 lb columbium metal powder as offset against 52,766 lb of the columbium concentrate objective.

4 Copper inventory includes 6,751 st copper contained in 9,645 st brass. Zinc inventory includes 2,894 st zinc contained in 9,645 st brass. (Brass slabs - 70% copper, 30% zinc.)

INTERNATIONAL ISSUES AND ACTIONS

ALUMINA, ALUMINUM, AND BAUXITE

Aluminum Projects Progressing in India: A $2 billion multifacility aluminum project in Orissa State in India, being constructed by the Government-owned National Aluminum Co., is scheduled to begin production by yearend 1986. A 2.4-million-mt/yr bauxite mine at Panchpatmalli has been completed and an 800,000-mt/yr alumina plant at Damanjode was scheduled for trial operations in September 1986. The first potline of the 218,000-mt/yr smelter at Angul is planned for completion in December 1986. India's aluminum production capacity will be 580,000 mt/yr when the Angul smelter reaches design output in September 1987, exceeding projected domestic demand by over 100,000 mt/yr. India will be self-sufficient in aluminum for the first time and will have a surplus available for export to world markets.

Jamaica To Revive Alumina-Bauxite Industries: Aggressive marketing measures taken by the Jamaican Government have succeeded in procuring new sales contracts for alumina produced by the Island's refineries. Clarendon Alumina Production Ltd., a state-owned company that leased and reopened Alcoa's 800,000-mt/yr Clarendon refinery last summer, plans to increase production to 1 million mt/yr. The Government seeks an agreement for 51% ownership in the plant, as well as a guarantee to ship raw bauxite. The Government is also negotiating with Kaiser Aluminum & Chemical Co. to restart the 1.2-million-mt/yr Alpart refinery, which was closed in August 1985 by Kaiser and Reynolds Metals Co. Jamaica is attempting to reverse a declining production trend that saw bauxite and alumina output drop 28% and 7.3%, respectively, in 1985.

Pechiney Plans Closures: France's only aluminum producer, the Government-owned Aluminium Pechiney, announced plans to close several smelters. The plants, which account for one-third of France's output, will be phased out over a 5-year period beginning in early 1987. The smelters, constructed prior to 1940, use inefficient technologies. The high cost of electricity in France prohibits modernization of the plants. Pechiney, one of the world's "Big Six" aluminum corporations, was nationalized in 1982. Under a new privatization law, and as part of the Government's plan to denationalize and sell 12 of the largest state-owned companies, including Pechiney, foreign investors can acquire up to a 51% share of the companies being sold.

Yugoslavia To Modernize Aluminum Plant: Yugoslavia has received a $32.4 million loan from the World Bank to help finance modernization of an aluminum plant. The facilities of UNIAL-Tovarna Glinice in Aluminija Boris Kidric, which have been in operation in Slovenia since 1954, will be overhauled and expanded at a total cost of $116 million. The work, scheduled to be completed by the end of 1988, will increase UNIAL's smelting capacity from 45,000 mt/yr to 70,000 mt/yr and upgrade the casting, quality control, and auxiliary facilities. The investment is expected to reduce production costs and enhance Yugoslavia's domestic supply of aluminum, thus saving foreign exchange. Aluminium Pechiney of France will provide technical assistance for the project.

Japanese Smelter To Close: Sumitomo Aluminium Smelting Co. Ltd., once Japan's largest primary aluminum producer, announced it will close its last operating smelter at Toyama in October. Reasons given for the closure were high energy costs and the recent appreciation of the yen. Sumitomo is the second major ingot producer to pull out of smelter operations in Japan this year, leaving only three primary aluminum producers in operation. Japan's 1986 aluminum production will be about 130,000 mt compared with a high of 1.2 million mt in 1977. Sumitomo's announcement came as a prelude to U.S. and Japanese talks on aluminum trade and tariffs held in mid-August.

BERYLLIUM

Cabot Corp. To Be Sold to Japanese Company: NGK Insulators Ltd. (Nagoya, Japan) reportedly has agreed to purchase the beryllium-copper alloy facilities of Cabot Corp. for about $45 million. The purchase includes Cabot's U.S. operations as well as distribution and sales operations in France and the Federal Republic of Germany. NGK, which claims to be the largest producer of beryllium-copper alloys in Japan, is expected to rename the acquisition NGK Metals Corp. Cabot is the second largest producer of beryllium-copper alloys in the world.

BRAZIL

Brazil Moving To Limit Foreign Control of Mineral Reserves: A bill approved by Brazil's Federal House of Representatives, and now before the country's Senate, could invalidate numerous joint ventures between foreign and Brazilian mining firms. The bill, said to be favored by the President of Brazil, covers development of columbium and other mineral deposits that are abundant in Brazil and vital to that country's industries and national security. Brazil accounts for over 80% of the columbium produced in the free market economy countries. The United States is 100% dependent on imports for columbium, and imports from Brazil satisfied over 60% of total U.S. columbium demand in 1985. Molycorp Inc., a U.S. corporation, holds a 45% interest in the Brazilian firm Cia. Brasileira de Metalurgia e Mineração, the world's largest columbium producer.

CHINA

Results of U.S.-China Trade Symposium: China could boost its exports of nine commodity groups to the United States, according to U.S. businessmen who attended the Symposium on U.S.-China Trade held in Guangzhou, Guangdong Province, in late July. Those commodity groups include crude petroleum and petroleum products, strategic and rare metals, and mineral products such as talc and barite.

COBALT

Japanese Company May Curtail Cobalt Production: Sumitomo Metals Mining Co. Ltd. (Japan) may be forced to curtail cobalt production beginning in October if Nonoc Mining and Industrial Corp. (Philippines), which supplies nickel-cobalt mixed sulfide to Sumitomo, does not resume production soon. The other Japanese cobalt producer, Nippon Mining Co. Ltd., reportedly suspended nickel and cobalt refining, beginning August 1, because of a lack of concentrate. Nippon's contract with the Greenvale Mine in Australia expired at the end of April, and was not renewed due to unprofitability. Nippon has been unable to locate new sources of feedstock. Japan imported more than 1 million lb of cobalt in both July and August compared to an average of slightly more than 400,000 lb/month in 1985 and an average of slightly less than 300,000 lb/month for the first half of 1986. This large increase in imports was attributed to cobalt consumers raising their inventory levels to take advantage of low prices and to the much diminished level of domestic production.

New Sulfur Removal System To Be Tested: Inco Ltd., a Canadian nickel-cobalt producer, is planning to test a new flotation technique to remove sulfur from ore at its Sudbury mines. Pyrrhotite, a sulfur-bearing mineral, is currently removed from the ore magnetically. Inco hopes to begin commercial-scale testing at its Copper Cliff mill in the spring of 1987. Inco must reduce its sulfur dioxide emissions from 765,000 st/day to 290,000 st/day by 1994 to meet stiffer Government regulations.

COPPER

Chile To Use Hydrometallurgy To Increase Copper Output: A significant increase in copper output and improved environmental conditions are likely to take place in Chile between 1987 and 1990 if Codelco-Chile (Codelco), the state-owned corporation, and privately owned companies complete planned installations of solvent extraction and electrowinning plants. Codelco's Chuquicamata Division plans to put onstream a 400,000-mt/yr, $78 million hydrometallurgical plant to treat waste ore dumps south of the main pit. Codelco is considering the use of a heap leaching process on ore heaps from the Mina Sur and plans to invest an additional $45 million in expansion of its solvent extraction-electrowinning plant for a total output capacity of 85,000 mt/yr of copper cathodes. Leaching of the Chiquicamata low-grade sulfide ore stocks is also being considered. At El Teniente, Codelco has also decided to double capacity of a small, 3,500-mt/yr fine copper plant used to treat copper-bearing acid mine water. With these additional plants, Codelco is expected to boost total fine copper production between 100,000 mt/yr and 150,000 mt/yr by 1990.

Privately owned Chilean companies considering new leaching, solvent extraction-electrowinning projects include Exxon's Cia. Minera Disputada de las Condes, which is evaluating a 10,000-mt/yr project using hydrometallurgical processes at its Los Bronces mine, and the Carolina de Michilla mining company. Carolina is expected to decide whether to double or triple its current 15,000-mt/yr production level of electrowon copper cathodes by yearend 1986.

DIAMONDS

Angola May Liquidate Diamond Company: The Angolan Government has proposed to foreign shareholders of Companhia de Diamantes de Angola (Diamang) to liquidate Diamang as a part of a reorganization of Angola's troubled diamond industry. The Angolan Government owns 77.2% of Diamang, Societe Generale de Belgique and Sibeka together own 18%, and the remaining shares are held by small foreign investors. Diamond production has decreased rapidly over the past 3 years owing to attacks on the company's dispersed mining centers by the National Union for the Total Independence of Angola, the kidnapping of foreign technicians, the disruption of overland transport to the mines from the coast, and rampant diamond theft and smuggling. To combat these problems after Diamang's dissolution, Angola has proposed to divide the diamond mining areas into smaller blocks, which will be contracted to foreign companies under production sharing agreements. In 1985, Angola produced approximately 2% of the world's diamonds (gem and industrial) with 1986 production likely to be even less. Although Angola's share of the world market is small, diamonds are its second largest foreign exchange earner behind crude oil.

GOLD

South Africa Mine Fire: A fire that spread toxic fumes through the workings of the Kinross gold mine in the Evander area of the Republic of South Africa resulted in the death of 177 miners and the hospitalization of many more. The accidental ignition of a foam material, applied to reduce degradation of the mine walls, reportedly was responsible for the fire, one of the worst in the history of South African mining. The mine was temporarily closed pending completion of inspections and clean up. Gold production was not seriously affected.

Gold Price Up at End of September: The price of gold rose from about $361/tr oz on August 1 to nearly $440/tr oz by the end of September, its highest level in over 3 years. The increase was attributed to growing concern by international investors over developments in the Republic of South Africa, global economic prospects, continuing weakness of the U.S. dollar, the return of inflation, and the erratic performance of the stock and bond markets.

Hong Kong Bans Krugerrands, To Issue Own Coin: Effective August 8, the Government of Hong Kong banned the importation of South African gold coins including Krugerrands and the new Protea coins, the second of an annual series of commemorative and legal tender coins launched in 1985. The ban is largely symbolic because no Krugerrands have been imported during 1986, and imports during 1985 were 60% less than those in 1984. Competition by other coins, such as the Canadian Maple Leaf, has been largely responsible for the reduction in sales of the South African coins. The Government of Hong Kong also announced plans in September to issue 32,000 gold coins to commemorate the visit by Queen

Elizabeth planned for October. The coins will be minted by the Mint of England from gold purchased on the international market.

Australia To Issue Gold Coins: The Government of Western Australia officially launched its new Australian Nugget gold coin series on September 1. Four coins commemorating the largest gold nuggets in the world, all discovered in Australia, will range in weight from 0.10 tr oz to 1.0 tr oz. Each will be stamped with the shape of a famous Australian nugget.

IRON AND STEEL

Losses in Japanese Steel Industry: Rapid appreciation of the yen in international currency markets is causing Japanese steel companies problems similar to those that troubled U.S. companies in the early 1980's. Although imports of steel are still only a small fraction of the Japanese market, they have been growing. More importantly, the higher valued yen makes some Japanese steel too expensive for export markets, where a large percentage of their sales are made. In the longer term, the high yen threatens sales of industries such as automotive and shipbuilding, which are major consumers of steel. Steel companies have postponed payments of dividends and reduced bonuses for workers because of financial losses and lower sales this year.

South Korea Expected To Increase Specialty Steel Capacity: South Korea's production capacity for specialty steel is expected to increase dramatically by 1990 in response to the demand from its expanding automotive and machinery manufacturing industries. Sammi Steel Co. intends to increase its annual production capacity of specialty steel from 150,000 mt in 1986 to 300,000 mt in 1987, and 450,000 mt in 1989. The company plans to install continuous casting equipment and high-luster stainless steel plate equipment, and to modernize its rolling facilities. Pohang Iron and Steel Co. plans to complete construction of a new 250,000-mt/yr plant by 1990; the plant will produce stainless hot coils, a product that South Korea now imports. Small specialty steel producers are also planning production expansion programs. Increased production in South Korea likely will disrupt specialty steel exports by Japanese and U.S. producers.

NICKEL

World Nickel Industry Remains Depressed: Despite labor problems disrupting production at several major nickel mining and processing operations during the spring of 1986, the price for nickel remains depressed. At the end of August, the London Metal Exchange (LME) nickel price fell to $1.65/lb, the lowest it has been since the end of 1982. The LME price peaked in June 1985 at $2.50/lb. As a result of the poor price, the Agnew Mining Co. Pty. Ltd. (Australia) ceased production at its mine on August 15. Low prices were also partially responsible for financial losses reported by Falconbridge Ltd. (Canada) for the first 6 months of 1986. Falconbridge, the second largest market economy country nickel producer and one of the lowest cost producers, has been profitable for the past several quarters. Rumored purchases of nickel on the LME failed to force the nickel price upward because heavy shipments and sales of Soviet nickel on the LME kept supplies ample.

Philippine Producer Facing Closure: Nonoc Mining and Industrial Corp., a major nickel producer located in the Philippines, reportedly may close. Costs to reopen following a strike this spring had been underestimated, and governmental approval of a $20 million loan application has not resolved the technical and financial difficulties confronting the company. The Philippine Government will provide only half of the funds called for by the loan; the source of the remainder is still uncertain. Marc Rich & Co. AG, which already has injected $23 million into the ailing company in exchange for becoming the exclusive agent for its nickel production, appears reluctant to provide additional funding. Low nickel prices and perceived poor local management at Nonoc could thwart other potential investors. If the mine remains closed, it will join several other recent closures, including the Agnew Mine in Australia and Nickel Mountain Mine in Oregon, as producers begin to reduce excess capacity.

POTASH

China Building Potash Facility: Construction began in mid-1986 on China's largest potash facility located in Qinghai Province. Qinghai potash fertilizer plant, a key project of the seventh 5-year plan (1986-90), is being built on Qarhan Lake, the largest of 31 salt lakes in Qaidam Basin. The dry lake covers 5,800 km^2 with salt deposits totaling 60 billion mt containing significant values of potassium and sodium as well as boron, bromine, lithium, and magnesium. First-phase construction of the 1-million-mt/yr facility is expected to be completed by August 1989, at an estimated cost of $85 million. This phase will yield 200,000 mt/yr of potash and will consist of a salt mining field covering 9 km^2, an ore dressing and processing mill, an equipment maintenance shop, and a power generator. China now is dependent on foreign sources, primarily Canada, for potash as a fertilizer ingredient. Although not currently a major consumer, China plans to increase its agricultural industry, and therefore, will have an increasing demand for potash.

RARE METALS

Japan Plans Exploration of Rare Metals in China: China and Japan reached a 5-year joint minerals exploration agreement on August 26 whereby the Metal Mining Agency of Japan (MMAJ) will assist the National Nonferrous Metals Industry Corp. of China in exploration for rare metals beginning in the early 1987. Exploration will take place in the northern part of Heilongjiang Province, where the Chinese have discovered cobalt, lead, molybdenum, vanadium, and zinc, and along the southern coast of Guangdong Province, where columbium, rare earths, tantalum, and zirconium have been discovered. MMAJ will provide technical assistance in exploration and in the separation of complex polymetallic minerals. MMAJ's budget for the joint project will be $2 million for fiscal year 1987.

SODA ASH

China Constructing Soda Ash Plants: Construction has begun on the last of three large soda ash plants scheduled for completion under China's 1986-90 5-year plan. The cost for each 600,000-mt/yr plant is estimated at $175 million. The new facilities are located in the Provinces of Hebei, Jiangsu, and Shandong. By 1989, when the plants are expected to be fully operational, the combined output is projected to nearly double China's current production of 2.2 million st/yr of soda ash. China currently imports about 1 million st/yr of soda ash for the manufacture of glass, detergents, and cleansers. China imports about 45% of its soda ash either directly or indirectly (through Taiwan) from the United States.

In a separate development, the OS Company of the United States is negotiating with Chinese authorities to construct a 300,000- to 600,000-mt/yr soda ash plant and a chlor-alkali plant in Yunnan Province.

SOUTH AFRICA, REPUBLIC OF

South African Metals, Mineral Products To Be Marketed in Taiwan: Taiwan will serve as a major marketing and distribution center in the Pacific Basin for various metals, mineral products, and gems produced in the Republic of South Africa. The Governments of Taiwan and the Republic of South Africa have agreed to cooperate in the marketing of synthetic diamonds, ferroalloys, and other metals such as titanium and silicon.

Stricter Controls on Exports To Be Imposed by South Africa: Economic sanctions urged by Zambia and Zimbabwe against the Republic of South Africa reportedly triggered an announcement by the South African Foreign Minister that South Africa would impose tighter controls on material passing through the country for export. The export of cobalt, copper, chromium, and nickel to market economy countries may be slowed by requiring stricter border control measures such as sight inspection of all cargo. Zambia and Zimbabwe use South Africa's ports for their export trade. Alternative routes are either poorly maintained, out of service, or being used at capacity. Although U.S. cobalt stocks are large, Zambia and Zaire report that the cobalt stocks they maintain in Europe are low because of the difficulties in getting material out of their countries. As a result, European cobalt prices may soon experience a significant increase.

U.S.S.R.

Improvement Reported in Soviet Mineral Production: The U.S.S.R. recently released production statistics for the first half of 1986, reporting increases in the production of six important mineral and fuel commodities. When compared with the same period last year, production levels show increases of 2% for iron ore and crude oil, 4% for coal, 6% for crude steel, 7% for natural gas, and 8% for mineral fertilizers. The statistics, which reflect the general improvement in the U.S.S.R.'s economic performance during the first half of the year, indicate that commodity production is increasing more rapidly than in recent years. Oil production, however, did not meet official targets for the period. This failure, coupled with lower world oil prices, is a serious problem for the Soviet Union, which depends on oil exports for a major portion of its hard currency earnings.

VANADIUM

Brazilian Company Considering Building Vanadium Plant: The Bahian Mineral Research Co., an agency of Brazil's Bahia State government, is concluding plans to build a 1,500-st/yr vanadium pentoxide plant. The feasibility of production of ferrovanadium is also being considered. The plant, expected to cost about $40 million, would use feed from magnetite ore deposits at Maracas (1.2% V_2O_5) and Campo Alegre de Lourdes (0.75% V_2O_5). The Bahia deposits are estimated to contain about 700 million st of ore. Production of vanadium pentoxide at the plant, which would be the first in Brazil, is expected to begin in 1988 and will be used to reduce imports. Brazil imported about 1,200 st of vanadium pentoxide in 1985.

ZAIRE

Gecamines of Zaire Continues To Stabilize Output: Despite low copper prices and difficult operating circumstances (i.e., the lack of efficiency in transport that has led to difficulty in supplying ore to the concentrators), Gecamines has managed to maintain near full capacity production, unlike numerous copper producers worldwide. Information recently made available from U.S. Department of State sources in Zaire gives production data for the first 6 months of 1986 for four principal mineral products produced by Gecamines, the state-owned mining company, as follows: copper, 236,059 mt; cobalt, 5,927 mt; cadmium, 179 mt; and zinc ingot, 32,092 mt. These output levels indicate that Gecamines has continued to stabilize output with the possible exception of cobalt and cadmium. The estimated 1986 total output is estimated at 11,800 mt (about 1,000 mt higher than that for all of 1985) for cobalt and over 300 mt for cadmium, the maximum possible output.

ZINC

Australian and Canadian Strikes Contribute to Rise in Zinc Prices: Zinc prices have risen rapidly in the past several months, mainly as a result of strikes at major zinc producing units in Australia and Canada, relatively strong world demand, and decreasing levels of world stocks. In September, most North American producers were quoting benchmark high-grade (HG) zinc at 47¢/lb, a 12¢ or 34% increase since the end of May. Winning bids at the U.S. Mint tender for zinc metal in early September averaged about 44¢/lb, indicating firm prices for the next few months.

FEDERAL, STATE, AND LOCAL ACTIONS

STEEL TASK FORCE

Steel Task Force To Be Established: The Reagan Administration, concerned that the bankruptcy filing by LTV Corp., the second largest U.S. steel producer, will establish a precedent for other steel companies, has established an interagency task force to study the steel industry's problems. If LTV is successful in using Chapter 11 to lower production costs and reduce liabilities, there will be tremendous pressure on other U.S. steel companies to follow suit.

ENVIRONMENTAL ISSUES

Phelps Dodge Fined for Environmental Violations: In a consent decree with the Justice Department, Phelps Dodge Corp. has agreed to pay a $1 million penalty for water pollution violations and spend more than $8 million to construct a water effluent-control system at its Morenci, AZ, copper operation. The decision came as a result of a complaint filed by the Environmental Protection Agency (EPA) in May 1986. EPA alleged that mill tailings and low-grade sulfide ores dumped on the Morenci property had infiltrated Chase Creek and the San Francisco and Gila Rivers, contaminating the area with cadmium, copper, lead, magnesium, and zinc pollutants. Phelps Dodge also will pay a $50,000 fine to the State of Arizona.

GOVERNMENT PROGRAMS

Abandoned Mines To Be Reclaimed in Wyoming: The U.S. Office of Surface Mining awarded a $12.9 million grant to the State of Wyoming for the reclamation of abandoned bentonite mines in Crook and Weston Counties. Last year, the State received $5.4 million from the U.S. Office of Surface Mining to reclaim abandoned uranium, gold, and bentonite mines and a limestone quarry.

Chemical Company Evaluates Bureau of Mines Waste Treatment Technology: If small-scale tests are successful, the Stauffer Chemical Co. plans to use a waste treatment technique devised by the Bureau of Mines to handle phosphatic clay wastes at its production facility in Mt. Pleasant, TN. Clay wastes, produced as slurries of water and fine clay particles, are difficult to dewater. Treatment by flocculating the wastes with polyethylene oxide causes the clay particles to agglomerate, permitting liquid-solids separation. The Bureau of Mines is assisting Stauffer to adapt the process to its operations.

Selenium Removal Research Yields Promising Results: The Bureau of Mines Twin Cities (MN) Research Center has identified a promising technique for removing selenium from agricultural runoff water from California's Kesterson Reservoir. Researchers reduced the selenium content in a Kesterson water sample from 4 to 0.1 ppm by circulating the water through a soil column over a 28-day period. The soil contained clostridium bacteria, which are known to consume selenium. The factors that control the bacteria-selenium reaction and techniques for accelerating the selenium removal process are being studied.

Crushing Machine To Be Used by Industry: A low-profile crushing machine developed under U.S. Bureau of Mines contract has caught the interest of the international mining industry. The new equipment, which is more compact than existing crushers and thus more suitable for underground use, allows mine operators to break mined ore into smaller pieces; the fragmented material can then be removed from the mine using low-cost conveyor systems. Mining companies in Canada and Indonesia recently ordered nine of the new crushing machines.

TRADE ACTIONS

Additional Talks on Steel Trade: The United States has requested talks with Canada, Sweden, and Taiwan concerning their increasing exports of steel to the United States. Imports of steel increased 24% in July, with much of the additional metal coming from countries that do not have voluntary restraint agreements (VRA's) with the United States. Canada and Sweden have firmly resisted formal VRA's in past negotiations, both countries claiming they do not engage in unfair trade practices.

New Mexico Granting Royalty Relief to Potash Firm: AMAX Chemical Corp. has become the first New Mexico potash firm to receive royalty relief from the State. The company began paying reduced rates for a period of 18 months ending January 31, 1988. The rate reduction will only apply, however, while the average value per short ton of product is below $65. The State's action is intended to encourage AMAX to continue potash production in New Mexico even though prices remain low.

In a related action, several potash mining officials from the Carlsbad, NM, area and the town's mayor met on August 21 with representatives of the Department of Commerce, the International Trade Commission (ITC), and the Bureau of Mines to discuss the alleged dumping of potash in the United States by Canada. Information presented at the meeting will be reviewed by Commerce and ITC officials to determine if dumping of potash is occurring and whether Government action is warranted.

LAND USE ISSUES

Forest Service Clears Company for Continued Exploration in Wilderness Area: The Montana Wilderness Association lost its bid to halt mineral exploration by U.S. Borax & Chemical Corp. in the Cabinet Mountains Wilderness, Lincoln County, MT. The wilderness association had challenged the validity of Borax's claims on stratabound copper-silver deposits, and demanded public disclosure of exploration data and a halt to drilling. The U.S. Forest Service will not stop Borax's exploration activity, and ruled that public disclosure of data would damage the company's position in a highly competitive trade situation. ASARCO Inc. also holds mining claims in the Cabinet Mountains; however, the wilderness association has not challenged the validity of these claims.

U.S. MINT

Minting of Gold Coins Has Begun: The Treasury plans to use 2 million tr oz of gold during the next year for the first legal tender gold coins to be minted in the United States since 1933. The gold content will range from 0.1 tr oz to 1 tr oz per coin and will be available for sale beginning October 1. The first 1-oz $50 gold bullion coin in this program was struck September 8, at the U.S. Bullion Depository in West Point, NY. The legislation authorizing the coin issue specified that the gold to be used in the minting must come from U.S. mines or, in the absence of adequate available supplies at world prices, from Treasury bullion reserves.

DEFENSE PRODUCTION ACT

Declining Ferroalloy Production Studied: A Department of Defense report on the impact of the country's declining ferroalloy production capacity on national defense preparedness concluded that although substantial excess capacity now exists worldwide, domestic ferroalloy capacity should be monitored because it has almost reached a minimally acceptable level for national defense purposes. The report further concluded that, in the event of mobilization, and with a loss of all African supplies, the ferrochromium in the stockpile would last for only 15 months. The Ferroalloys Association has critisized the report for making overly optimistic assumptions about the availability of alternative sources of supply by assuming that ferrochromium demand could be met, even if supplies from South Africa were disrupted, by a combination of plant conversion in Japan and Europe and drawdown of the U.S. strategic stockpile. The report also assumes that no shipping losses occur, and that all existing U.S. unused processing capability is immediately available when needed.

U.S. MINERAL INDUSTRY HIGHLIGHTS

ABRASIVES

Dollar Value of Abrasives Declines: The Abrasive Grain Association reports that total net dollar sales of graded grain abrasives to domestic manufacturers and users for the first 6 months of 1986 were 20% less than for same period during 1985. Furthermore, total domestic dollar sales of crude ore (unground silicon carbide and fused alumina oxide) by prime producers for abrasives and/or refractory use experienced a 19% decrease for the same time period. The decrease in value includes all grades of fused aluminum oxide abrasives and silicon carbide. The abrasives industry has seen a sharp drop in demand for its products, largely used by the steel, automotive, and other basic industries. The 1985 dollar value of end uses of aluminum oxide and silicon carbide was 20% less than that for 1984.

Standard Oil To Divest Abrasives Business: Standard Oil (Ohio) plans to sell four of its industrial products businesses that do not fit the company's growth plans. Those businesses include its Electro-Minerals Group, Niagara Falls, NY, a major producer of fused alumina and silicon carbide, with plants in the United States, Canada, Mexico, Brazil, and Norway. This planned divestiture marks the third time in 3 years that a major company has decided either to merge or spin off abrasives segments that no longer mesh with its long-term strategies and because of poor growth potential. Standard Oil acquired the Electro-Minerals Division from the Carborundum Co., in one of these spinoffs, and now, in turn, will offer that division for sale.

ALUMINA

Composite Tool Inserts Introduced: Alumina-based ceramic cutting tool inserts reinforced with single-crystal silicon carbide whiskers were introduced at the International Machine Tool Show held in Chicago in August. Although pure alumina ceramic material is extremely hard and maintains a sharp cutting edge at very high temperatures, its tendency to chip and fracture when subjected to mechanical shock precluded its use as a high-speed cutting tool. The addition of silicon carbide whiskers appears to have overcome this problem. The three companies that introduced the composite inserts--General Electric's Carbaloy Systems Dept., Kennametal Inc., and Sandvik Coromant Co.--contend that the new inserts can cut high-temperature alloys at speeds 10 times faster than tungsten carbide inserts and 50% faster than silicon nitride inserts.

Alcoa Restructuring: The Aluminum Co. of America (Alcoa) will be restructured into five operating groups: Alcoa Packaging System Group (development and production of aluminum, polymer, and other packaging materials); Alcoa Aerospace & Industrial Products Group (aerospace, defense, automotive, and industrial markets); Alcoa Metals & Chemicals Group (bauxite mining, alumina refining, and aluminum smelting and fabricating operations, as well as Alcoa's magnesium and industrial chemicals operations); Alcoa Materials Science Group; and Alcoa International Group. The realignment is part of a corporate strategy for achieving long-term profitable growth by focusing more on profitable business opportunities in advanced materials and on its moneymaking aluminum operations.

Alcoa Seeks Utility Rate Break: Alcoa is seeking an electricity rate cut for its primary aluminum smelter from the State of New York and the town of Massena, NY. The company claims that up to 2,000 jobs could be lost at the plant if the request is not granted. The plant, which was struck by union members between June 1 and August 1 of this year, has an annual capacity of 226,000 st/yr and a current operating rate of 186,000 st/yr.

AMMONIA

Price of Ammonia Lowest Since 1973: The ammonia industry continued to adjust to the pressures of increasing ammonia imports from Canada, the U.S.S.R., and Trinidad and Tobago, the high cost of natural gas, and falling product prices. The spot price of gulf coast ammonia, $200/st in early 1984, is now about $74/st, the lowest since 1973, with no relief in sight. Eighty percent of U.S. ammonia production is consumed by the agricultural industry. Except for brief periods, the price and production of ammonia in the United States has declined since 1980.

CEMENT

Kilns To Be Converted: Dundee Cement Co. and Continental Cement Co., both of Clarksville, MO, plan to convert their coal-powered kilns to burn flammable chemical wastes. The conversions, which must be approved by government environmental agencies, would provide an alternative method for disposing of hazardous wastes produced by chemical plants in St. Louis and other Midwestern cities.

GOLD

Molycorp Plan To Prospect, Mine, and Mill Gold in New Mexico Disapproved: The Molycorp Inc. (a division of Unocal Corp.) plan to prospect for, mine, and mill gold in an area 1.5 miles west of the town of Red River, NM, was disapproved on September 18 after Molycorp sent notice of intent to the U.S. Forest Service on June 16, 1986. The Forest Service cited a 1980 New Mexico law requiring a wilderness study area to be maintained in its existing wilderness character. Molycorp was not denied the right to mine or test for gold, but the decision prevents Molycorp from using large truck-mounted drill rigs. Molycorp intended to drill about 20 test holes on leased land in the Carson National Forest, an area close to the proposed Columbine-Hondo Wilderness Study Area. Some public concerns were expressed over the dangers of cyanide, traditionally used to dissolve gold in gold-bearing ores.

IRON AND STEEL

USX Work Stoppage Expected To Have Minimal Impact on Steel Supply: Production at the steel division of USX Corp. was stopped on August 1, when its labor contract with the United Steelworkers union expired. The work stoppage has idled 22,000 union workers, but is not expected to affect the short-term supply of steel because of ample inventories and excess domestic production capacity. Other steel companies boosted prices for flat-rolled steel in anticipation that the labor dispute at the Nation's largest steel producer would result in more orders for them.

Courts Rule on USX Labor Dispute: The Minnesota Department of Jobs and Training has ruled that 1,300 union workers at USX's Minntac plant in Mountain Iron, MN, were "locked out" on July 31 when their national contract ended and are thus eligible to receive unemployment benefits, a ruling affirmed by government agencies in nine other States. Although USX maintained that the workers were on strike, the union maintained that they had offered to continue work under their old contract while negotiations continued, but that management had rejected that offer. As a result of the State's decision, workers will be able to receive $239/week for 39 weeks. If unemployment benefits had been disallowed, the workers would only have received $60/week in strike benefits from the union. USX plans to appeal the decision.

In contrast to the Minnesota decision, the Utah Office of Employment Security has ruled that steelworkers at USX Corp.'s Geneva Works are on strike. The Utah ruling, which disqualifies the Geneva workers for unemployment benefits, was based on statements and action by the United Steelworkers of America (USW), which indicated that it might strike USX, placing the company in a "defensive mode" by shutting down plants like Geneva. The union plans to appeal the ruling.

Armco Settles Strike: Union members at Armco Inc.'s Middletown, OH, steel mill agreed to a new contract freezing most wages and benefits. A clause in the contract, however, allows the company to reopen negotiations if profits at the plant do not exceed an agreed upon level during the coming year. Armco, the fifth largest U.S. steelmaker, is financially weak; the company claims a strike could force it into bankruptcy.

CF&I To Sell Property and Mineral Rights: CF&I Steel Corp. of Pueblo, CO, plans to cut continuing losses by selling up to $15 million in property and mineral rights and by seeking wage concessions from its workers. A loss of $7.2 million in the first half of 1986, following losses of $3.4 million in 1985 and $28.1 million in 1984, led to the closing of a tubular steel production plant by the company, which specializes in making tubular steel for the oil-well drilling industry, railroad rails and wire rods, and other steel bar products. The company has been adversely affected by reduction in oil-well drilling and the change in competitive relationships in the steel industry resulting from the recent Chapter 11 bankruptcy of LTV, the Nation's second largest steelmaker.

LTV To Idle Four Bar and Pipe Mills: LTV took steps to shrink its steel operations after filing for Chapter 11 bankruptcy by announcing that it will idle major portions of four of its bar and pipe mills indefinitely. The company will lay off 1,785 workers at facilities in Indiana, Illinois, and Ohio. Competition from minimills and slack demand from the automotive and petroleum industries had already caused production cutbacks at the mills. Shutting down these operations will halve LTV's barmaking capacity.

LEAD, ZINC

St. Joe and Homestake Plan Lead-Zinc Merger: St. Joe Minerals Corp. and Homestake Mining Co. have a preliminary nonbinding agreement to combine their domestic lead and zinc operations and contribute the assets of their Missouri lead and zinc mines and smelter operations toward a new business entity, 57.5% owned by St. Joe and 42.5% owned by Homestake. The target date for reaching a definitive agreement is November 1. The merged facilities will represent two-thirds of the United States lead mining capacity, one-fifth of its zinc mining capacity, and over one-half of its refined lead capacity.

PLATINUM GROUP METALS

Speculative Activity Raises Platinum Price: The price of platinum metal soared 11% to $531/tr oz in 1 week in mid-August in speculation spurred by concern that the Republic of South Africa will retaliate against the West for imposing trade sanctions. The Republic of South Africa has a near monopoly on the world's platinum supply; export disruptions could cause shortages for automobile manufacturers and other large consumers of platinum.

Manville Corp. To Continue To Invest In Stillwater: Manville Corp. received permission from bankruptcy court to continue investing money in the development of its platinum-group metals deposit in the Stillwater Complex, MT. The court ruling increases the prospect that the Stillwater Mining Co., made up of Chevron Resources, Lac Minerals, and Manville, will begin mining palladium and platinum at Stillwater in 1987.

SAND, INDUSTRIAL

Continuous Steel Casting Reducing Demand for Industrial Sand: The growing number of continuous casters in the Chicago District steel mills has affected two plants producing ingot molds from industrial sand. Vulcan Mold & Iron Co., Lansing, IN, has been "temporarily idled" since January 1, and Valley Mold & Iron Co., South Chicago, IL, notified its workers in May that it will be shutting down permanently because of the lack of current business and future prospects. With the introduction of three additional casters early in 1986, most of the Region's mills are producing steel without molds. The molds are used to cool and form molten steel using the older steelmaking process.

SODIUM CARBONATE (SODA ASH)

Wyoming Hopes for Greater Exports to Japan: As part of an effort to increase export of soda ash produced in southwest Wyoming, Senator Malcolm Wallop (R-WY) escorted Japanese Ambassador Nobuo Matsunaga on a tour of a soda ash producing plant in Wyoming in late August. The soda ash industry believes Japan could double its current imports of Wyoming soda ash to 400,000 st/yr, which could add $60 million and more jobs to the Wyoming economy.

TITANIUM

McDonnell Douglas Increases Capacity for Advanced Forming and Bonding Techniques: McDonnell Aircraft Co. (St. Louis, MO), a division of McDonnell Douglas Corp., has doubled its capacity for using superplastic forming (SPF) and diffusion bonding to produce aircraft parts from titanium. A new $2.5 million press, installed in April 1985, will serve 10 molding units, 7 of which are now operational. The SPF process involves heating sheets of titanium to about 1,650° F in an inert gas atmosphere and forming shapes up to several times the size of the original material. Diffusion bonding allows parts to be joined by atomic diffusion without melting. These processes are being used by McDonnell to make engine bays and other parts for F-15E fighter aircraft.

Titanium Dioxide Price Increases Announced: U.S. titanium dioxide (TiO_2) producers announced price increases of 2¢/lb to 3¢/lb, effective October 1, 1986. The price of rutile pigment will rise to 80¢/lb to 83¢/lb, and that of anatase pigment to 77¢/lb to 78¢/lb. U.S. TiO_2 pigment consumption in the first 6 months of 1986 was 506,000 st, 4% higher than the half-year rate of 1985, which was the third consecutive record-high year. The price increases are intended to offset higher costs of production and materials and the rising expense of complying with environmental regulations. Producers also hope to take advantage of the continued high demand for titanium dioxide pigments.

SELECTED NEW CONTRACTS, INVESTMENTS, EXPANSIONS, AND EXPLORATION ACTIVITIES: UNITED STATES

Commodity and Company	Operation and/or Location	Notes
ABRASIVES		
Kenmare Capital Corp.	Metallic abrasives plant, Butler, PA.	Purchased the Pangborn Co., which operated a metallic abrasives plant in Butler, PA, from the Kennecott Corp. The sale represents Kennecott's 2d divestiture of an abrasive materials facility. In 1985, Kennecott sold the Sand Paper Division of Carborundum Abrasives Canada to Norton Canada, Inc.
ALUMINUM		
Aluminum Co. of America (ALCOA).	Alcoa, TN.	United Steelworkers of America (USW) approved a new 3-yr contract that reduces by 95¢ the previous benefits package of an average $11/h. Of the 2,900 union workers at the smelter, about 260 will be furloughed because of business lost during the strike.
"	Rockdale, TX, and Wenatchee, WA.	Restarted potlines at its primary aluminum plant in Wenatchee in mid-July. Workers at the Rockdale plant returned in mid-August. 2 of Rockdale's 6 potlines were shut down during the strike there; only 1 has been restarted. These actions brought ALCOA's smelting operations to 85% of their rated annual capacity of 1.1 million mt.
Inco Alloys International.	Pittsboro, NC.	Announced plans for a new $4 million plant to produce alloyed aluminum and other light metal products. The plant should be completed during the 1st quarter of 1987 and will give the company a base for expansion into other alloy systems, such as titanium, magnesium, lithium, and zirconium.
Martin Marietta Aluminum Inc.	Smelter at The Dalles, OR.	Agreement has been reached on a lease-purchase to reopen the Martin Marietta Aluminum Inc. smelter at The Dalles, OR. The agreement between Martin Marietta and Northwest Aluminum Inc. may allow the plant to begin operating by yearend with an initial production of 45,000 st/yr. 200 employees were laid off when the smelter closed in December 1984. Northwest Aluminum, a company formed by a group of Northwest businessmen in 1985, has reportedly negotiated a new union contract and an agreement with the Bonneville Power Administration that ties electrical power rates for the smelter to the price of aluminum.
Reynolds Metal Co.	Foil, powder, and extrusion operation, Louisville, KY.	Ratification of a new 3-yr contract by the Aluminum Brick and Glass Workers International Union returned striking workers to the Louisville operation on Aug. 9. The workers had been on strike since July 14.
"	Cable plant, Longview, WA.	Workers returned to work after a 4-wk strike. The strike idled 170 hourly workers.
BARITE AND BENTONITE		
Dresser Industries Inc., and the Halliburton Co.	Drilling-fluids Operations.	Announced plans to merge their drilling-fluids businesses in a joint venture. The companies said the proposed venture is in response to the cutback in oil and gas drilling caused by declining oil prices. The Dresser Divisions involved are Magcobar North America, Magcobar International, and Magcobar Minerals, excluding its lead mining operation. The Halliburton unit involved is IMCO Services Division. Both companies have worldwide barite and bentonite mining, processing, and grinding interests.
BERYLLIUM		
Emergy Energy Inc., and Cominco American Inc. (subsidiary of Cominco Ltd., Canada).	Juab County, UT.	Announced the formation of a joint venture to mine and mill beryllium ore from Emery's property. Mineralization on the property reportedly is similar to that of Brush Wellman Inc.'s adjacent bertrandite mine. Reserves on Emery's property are estimated to be about 500,000 st, grading 0.64% beryllium oxide.
CARBON DIOXIDE AND NATURAL GAS		
Exxon Corp.	Shute Creek gas processing plant, Overthrust Belt Area of WY.	Announced that its Shute Creek gas processing plant, under construction for 2 yr, began limited commercial operation in August. The plant was designed to process up to 480 million cubic feet of gas daily, of which about 27% will be natural gas or methane used for heating purposes and 58% carbon dioxide (CO_2). Exxon has contracted to sell up to 200 million cubic feet of CO_2 daily to Chevron USA for enhanced oil recovery at a northern Colorado oilfield.
CEMENT		
Huron Cement Div. of National Gypsum Co.	Alpena, MI.	Received approval from the Federal Trade Commission for the sale of certain assets to LaFarge Corp. for $20 million. Under terms of the agreement, LaFarge will buy 6 cement distribution terminals in the Great Lakes area. In addition, LaFarge will purchase a 50% interest in a joint venture involving 8 other distribution terminals. LaFarge will also get an option to buy National Gypsum's 50% interest in the venture and its Alpena cement plant.

CLAY		
General Shale Products Corp.	Johnson City, TN.	Announced plans to sell the company to Marley PLC, a United Kingdom firm. Marley will purchase 58% of General Shale's outstanding common stock at $30/share from the company's director-shareholders. Marley has wanted to expand its building materials business to the United States; the availability of General Shale, one of the big three brick companies (Acme Brick Co., General Shale, and Glen-Gery Co.), with its many facilities and the experience of its existing management, provided the opportunity for Marley's expansion. If the proposed buy-out goes through, of the big 3, only Acme Brick will be in U.S. hands.
COLUMBIUM-TANTALUM		
Advanced Refractory Technology Inc. (ART) and Greenbushes Tin Ltd., Australia.	Buffalo, NY.	Formed a joint venture to produce columbium and tantalum carbide powders, for worldwide sales, from oxides produced by Greenbushes in Australia. Commercial production of the powders is underway at ART's facilities in Buffalo.
COPPER		
Kennecott Corp.	Bingham Canyon Mine, Salt Lake City, UT.	Expected to resume mining by early October. The company agreed to reopen the facility as part of a contract settlement reached with 13 unions in July. By the end of 1986, Utah Copper Divison is expected to employ 1,500 workers, up from 250 in August. The concentrators are expected to be restarted in January, followed by the smelter and refinery. Production at the facility is expected to reach 60,000 st/d of ore by mid-1987, assuming copper prices do not fall below current levels.
Phelps Dodge Corp.	Chino Mines Co., Grant County, NM.	Announced on Sept. 11 that it had reached an agreement in principle with Standard Oil Co. to purchase Kennecott Corp.'s 2/3 interest in Chino Mines Co. The $93 million purchase will take place in early 1987. Phelps Dodge intends to honor labor agreements reached at Chino Mines in mid-July.
COPPER-MOLYBDENUM		
Montana Resources Inc.	Butte, MT.	Mining resumed in mid-July at the East Berkeley Pit, following a 3-yr closure. East Berkeley Pit has been renamed the Continental Pit by Montana Resources. Full capacity of 40,000 st/d of ore was expected by the end of August. Copper concentrates were to be exported to the Far East, while molybdenum concentrates were to be sold to traders for the European market. The 1st shipment of 2,000 st of copper concentrates was made on Aug. 27.
CRUSHED LIMESTONE		
American Cyanamid Co.	Quarries and plants at Alden and Weeping Water, NE.	Purchased by Iowa Limestone Co., Des Moines, IA. Will increase Iowa Limestone's employment from 60 to 80 or 90 people.
GOLD		
Amselco Minerals Inc. and Galactic Resources Ltd.	Gold project, Ridgeway, SC.	Signed participation and mining operations agreements for the Ridgeway project, a recently discovered gold deposit in Fairfield County reportedly containing 51 million mt of ore reserves. The agreement defines the working relationship between the 2 companies during development and operation of the Ridgeway Mine. Startup is scheduled for the 2d half of 1988.
Asamera (U.S.) Inc. and Breakwater Resources Ltd.	Cannon Mine, Wenatchee, WA.	Reports that repairs to the ball mill have been completed and gold production resumed Aug. 19. During the shutdown, underground development continued and additional stope blocks were drilled.
Echo Bay Mining Co.	The Sunnyside Mine, Silverton, CO.	Returned the mine to full production. Employment is 280, plus 14 summer temporaries. Mine output is 1,200 st/d, and the mill now processes about 900 st/d. Echo Bay spent approximately $6 million refurbishing the mine, acquired from Standard Metals Corp. in November 1985. The operation is expected to produce 25,000 tr oz of gold and 300,000 tr oz of silver in 1986, with byproducts of zinc, lead, and copper.
Freeport-McMoran Gold Co.	Jerritt Canyon Mine, Elko County, NV.	Began gold production at the mine's new heap leaching facilities. The facility is designed to process about 400,000 st/yr of ore. Leaching operations began on Aug. 7, and the 1st gold bar was poured on Aug. 18.
Kiewitt Mining and Engineering Co.	Rawhide, NV (northwest of Hawthorne, NV).	Developing a new gold mine with estimated known reserves of about 24 million st averaging 0.045 tr oz/st gold, which can be processed at a rate of 2 million st/yr. The labor force, estimated at about 135 workers during full-scale operations, will operate one of the larger heap leaching projects in the Nation.
Royal Gold Inc. (subsidiary of Royal Resources Corp., Chipeta Mining Corp., and Ouray Ventures Inc.).	Camp Bird Mine, near Ouray, CO.	Entered into an agreement with Camp Bird Colorado, a subsidiary of Federal Resources Corp., to lease the mine, which has been one of the largest gold producers in North America with cumulative gold production of more than 1.4 million tr oz. In recent years, however, the mine has been in an exploration and development phase with limited production.

Western Goldfields Co.	Hog Ranch Mine, Washoe County, NV.	New open pit gold mine and heap leaching operation expects to produce 50,000 to 55,000 tr oz/yr of gold. Leaching began in August, and the 1st gold was poured on Sept. 14.

GOLD AND SILVER

Atlantis Mining & Manufacturing Co.	Atlantis Mine, Blaine County, ID.	Contracted with U.S. Antimony Corp. to process gold and silver ore from the Atlantis Mine at U.S. Antimony's custom mill on the Yankee Fork, Salmon River. Initial shipment of 400 st will be repeated if preliminary mine assays are favorable.
Echo Bay Mines Ltd.	Borealis Mine, Manhattan Mine, and McCoy Mine, NV.	Echo Bay purchased the precious metal assets of Tenneco Inc., which includes the Borealis, Manhattan, and McCoy Mines in NV.
Kennecott Exploration (subsidiary of Kennecott Corp.).	Almeda Mine, Josephine County, OR.	Announced plans to drill 12 test holes at the Almeda Mine, Josephine County, OR. The mine produced gold, silver, copper and lead between 1911 and 1916. The property was test-drilled in 1982 by Blue Diamond Energy Resources Inc. and Comanche Petroleum Inc., both of Vancouver, British Columbia, Canada. Results of the test drilling are unknown.
Royal Apex Silver Inc.	Rochester, NV.	Poured the 1st gold-silver doré bar at the Rochester property in September. The property, near Lovelock, NV, is being developed and put into production via open pit mining methods by Coeur d'Alene Mining Corp. of Wallace, ID. The Rochester Mine is expected to produce 3.8 million tr oz/yr of silver and 43,000 tr oz/yr gold.

GOLD, SILVER, AND MERCURY

FMC Corp.	Paradise Peak Mine, Gabbs, NV.	Held official dedication in July of mine employing 200. The 12 million-st deposit contains 1.1 million tr oz of recoverable gold and 30 million tr oz of recoverable silver. The mill will produce an average of 100,000 tr oz/yr of gold and 3.5 million tr oz/yr of silver through 1996.

IRON AND STEEL

Allegheny Ludlum Corp. Special Materials Div.	Lockport, NY.	Started production from a newly installed 18-st argon-oxygen decarburization (AOD) vessel and restarted 3 15-st furnaces already in place. Prior to the AOD installation, Special Materials had been operating a 9-st vacuum melting furnace. The furnace installation and other expansions cost $2.1 million.
Babcock & Wilcox Co.	Beaver Falls, Koppel, and Ambridge, PA, plants.	Contract expired Aug. 16 but extended until Sept. 13. B&W produces seamless tube and employs 1,400 workers.
California Steel Industries Inc.	Fontana, CA.	Agreement reached on purchase of remaining 50% of the company by its foreign partners. Kawasaki Steel Corp. of Japan and Rio Doce Ltd. of Brazil initially owned 25% each of California Steel, but will now control 50% each. The partners announced plans to renovate and upgrade the hot strip mill, 5-stand rolling mill, and reversing mill at the 850,000-st/yr facility. No shrinkage in the 750 employee workforce is foreseen in the next 2 yr.
Cleveland-Cliffs Iron Co.	Empire and Tilden Mines, Ishpeming, MI.	Averted strike on Aug. 1, after 1,600 members of the United Steelworkers Union (USW) agreed to a 9-month contract extension. The company plans to increase pellet production in 1986 at the Empire Mine about 500,000 lt to 7.2 million lt, or 90% of capacity.
Continental Steel Corp.	Bar mill, Joliet, IL.	Sheffield Steel Corp., an Oklahoma-based minimill operator, completed its purchase of Continental Steel Corp.'s bar mill in Joliet after reaching an agreement with the plant's 200 employees on a 42-month contract. Continental Steel is in the process of liquidating under Chapter 7 of the U.S. Bankruptcy Code.
Ford Motor Co.	Rouge Steel Subsidiary, Detroit, MI.	Avoided a walkout that could have shut down Ford Motor Co.'s Rouge Steel subsidiary when 4,200 members of the United Auto Workers Union agreed to a 60-d extension of their contract.
Inland Steel Mining Co.	Minorca Mine, Virginia, MN.	Employees approved a new 3-yr contract on July 8. The contract froze wages, reduced Sunday premium pay, and suspended future cost-of-living raises. In return, the workers received improved pensions payments, seniority rules, and a profit-sharing plan with no cap.
Intercoastal Steel Corp.	Norfolk, VA.	Purchased by Birmingham Steel Corp. (Birmingham, AL) for $6.5 million in cash. The private minimill has an annual capacity of about 175,000 st, and will be making rebar primarily for the East Coast market. The fully owned subsidiary has been renamed Norfolk Steel Corp.
LTV. Corp.	Erie Mining Co., Hoyt Lakes, MN.	Signed 9-month contract extension on July 28. The 1,000 employees will be subject to wage and benefit cuts only through bankruptcy court actions and not by unilateral action of the company while it is in Chapter 11 proceedings.

LTV Corp.	Erie Mining Co., Hoyt Lakes, MN and McKinley natural iron ore mine, Aurora, MN.	Plans to triple taconite production at its wholly owned Erie Mining Co. complex to 6 million lt of pellets this year and continue production at the McKinley Mine at 500,000 lt/yr.
''	Harbor Works, East Chicago, IN.	Agreed to restore insurance benefits to its retirees, ending a 6-d strike begun on July 25 by [illegible],400 workers at the Indiana Harbor Works. The impasse was resolved when LTV received approval from a bankruptcy judge to restore the benefits even though the move was opposed by its bank creditors. The union had been prepared to strike LTV's Cleveland Works, the company's largest facility. That action would have idled half LTV's steelmaking capacity and, with the USX strike, seriously disrupted steel markets.
Newport Steel Corp.	Newport, KY.	The company has locked up a $12 million financing package to buy the shuttered Kentucky Electric Steel Co. in Coalton, KY. Newport Steel plans to put the 300,000-st/yr plant back in production before yearend.
Northwestern Steel & Wire Co.	Sterling, IL.	Received a $2 million loan from the State's "Build Illinois" program to help with a $10.5 million renovation of its wire division. Expected to be completed in April 1987, the firm plans to expand the facility, replace antiquated machinery and methods, continue work on its descaler, and modernize its 14-in mill. Northwestern Steel and Wire achieved profitability for the 1st time in 5 yr when its fiscal year ended on July 31.
LEAD		
Cominco Alaska, Inc.	Red Dog Mine, Northwest Artic Borough, AK.	Completed a barge dock and cargo-handling area at the port site about 17 miles southeast of Kivalina on the Chukchi Sea. This 1st link in the DeLong Mountains Transportation System was built for the Alaska Industrial Development Authority by Enserch Construction, Inc. The Development Authority will begin seeking bids in December for a 55-mile-long road to the Red Dog Mine. Construction of the mine could take 4 yr with production beginning in 1990-91 with a concentrator design capacity of 6,700 sdt/d.
LEAD-SILVER		
Pegasus Gold Inc.	Montana Tunnels Mine, Jefferson County, MT.	Contracted with Asarco Inc. to supply 11,000 st/yr of lead-silver concentrates to ASARCO's East Helena, MT, lead smelter.
MOLYBDENUM		
American Metal Climax Inc. (AMAX).	Climax molybdenum mine, near Leadville, CO.	Reached agreement in mid-August with workers on a new 3-yr contract. The workers, represented by the Oil, Chemical and Atomic Workers International Union and the International Brotherhood of Electrical Workers, accepted a 13% cut in wages. AMAX's other large molybdenum mine in Colorado, the Henderson Mine near Empire, is not unionized.
MOLYBDENUM AND VANADIUM		
AMAX joint venture with CRI Ventures.	Port Nickel, LA.	Began production at its recently converted spent petroleum catalyst reclamation plant. Initial production is expected to be about 125 st/month of molybdenum and about 106 st/month of V_2O_5. The molybdenum will be converted to the oxide at AMAX's Fort Madison, IA, roaster; the V_2O_5 will be converted to FeV at its Langeloth, PA, plant. Also, about 4 st/month cobalt and nickel residues will be recovered.
NICKEL		
The State of Minnesota.	Northern Minnesota deposits.	The Department of Natural Resources announced plans for a minerals lease sale by yearend 1986. The tracts offered include several in the Duluth Gabbro Complex, which hosts the Nation's largest deposit of nickel, plus copper, cobalt, and precious metals.
PHOSPHATE		
Agrico Chemical Co.	Polk County, FL.	Reopened its Saddle Creek and Fort Green mines with 318 employees. No further shutdowns are expected through the end of 1986.
Chevron Chemical Co.	Rock Springs, WY.	Began receiving phosphate concentrates at the new chemical complex at Rock Springs. The 450,000-st/yr fertilizer plant received concentrates through a 95-mile-long slurry pipeline originating at Vernal, UT. The 1st marketable product was shipped at the end of May to independent fertilizer dealers in Western and Midwestern States. Most of the complex, after 2 yr of construction, was on-stream by July. The complex includes a sulfuric acid plant, phosphoric acid plant, diammonium phosphate granulation plant, and super phosphoric plant.
International Minerals & Chemical Corp.	Polk County, FL.	Reopened all of its Polk County mines, which had been closed for 6 wk. The mines had been shut down in June and reopened in August.
Mobil Mining and Minerals Co.	Polk County, FL.	Restarted its Fort Meade Mine in July after the annual maintenance turn around.
J. R. Simplot Co.	Smoky Canyon Mine, Caribou County, ID, and phosphate fertilizer plant, Pocatello, ID.	Reopened mine on Aug. 28 and resumed operations at fertilizer plant after a 7-wk closure to reduce inventories. Approximately 450 employees were recalled for the 2 operations.

SODIUM CARBONATE (SODA ASH)		
General Chemical Co. (formerly Allied Chemical Co.).	Trona Mine and Soda Ash Plant, Green River, WY.	Reached agreement on a 1-yr contract with the USW. The new contract did not cut wages or insurance benefits for current employees but eliminated cost-of-living allowances and company-paid busing, and reduced consideration of seniority in job assignments. In addition, new hires will receive $4.50/h to $7/h less than current employees. General Chemical had already announced a layoff of about 90 workers in mid-August because of a continuing slump in demand for soda ash, about 50% of which is used for glass manufacture.
SULFUR		
F. E. Ward Co.	Construction, Vancouver, WA.	Started production of prefabricated acid tanks using Bureau of Mines-developed sulfur concrete. Scientists at the Bureau's Albany (OR) Research Center provided technical assistance to the company, which is a licensee of the Bureau's patent for the corrosion-resistant construction material.
TITANIUM		
McDonnell Aircraft Co.	St. Louis, MO.	Doubled capacity for using superplastic forming and diffusion bonding to produce aircraft parts from titanium. McDonnell is using these processes to make engine bays and other parts for the F-15E fighter aircraft.
Scot Pump Co.	Cedarburg, WI.	Scot Pump was the apparent low bidder on a contract for the production and delivery of 675 titanium fire-fighting pumps for Navy surface vessels. The $15.9 million proposal, amounting to about $23,600/pump, was considered to be cost effective compared with a bid of $40,000/pump the Navy received for an overhaul of existing brass and stainless steel pumps. Titanium is effective in marine environments because of its high strength-to-weight ratio and superior resistance to salt-water corrosion.
TUNGSTEN		
Li Tungsten Corp.	Depew, NY.	Attempting to put together a $6 million financing package to reopen in Depew, about 10 miles east of Buffalo. The company formerly operated a tungsten processing facility at Glen Cove, NY, but was forced to declare bankruptcy in 1985 and closed the plant in early 1986 because of high utility costs coupled with high taxes and the general economic downturn.
URANIUM		
Rocky Mountain Energy Co. (Union Pacific Corp. subsidiary).	Various locations.	Signed an $18 million contract with the Taiwan Power Co. for a 5-year uranium exploration program on Rocky Mountain Energy properties in Arizona, Nebraska, Texas, and Washington. Uranium would be used to fuel 4 nuclear reactors in Taiwan.
VANADIUM		
Strategic Minerals Corp.	Hot Springs, AR. (Stratcor).	Met the Sept. 1 target date for bringing its Hot Springs vanadium oxide mill back into production. The mill had been closed for modernization since November 1985. Stratcor, an employee group that bought the tungsten and vanadium assets of Umetco Minerals Corp. earlier this year, will operate the Hot Springs mill at one-half its annual capacity of 12 million lb of vanadium pentoxide equivalent. The mill will use vanadium-bearing residues from oil refineries to produce vanadium pentoxide and vanadium trioxide. The Hot Springs vanadiferous clay mine, which was shut down with the mill, will remain closed.
ZINC		
Asarco Inc.	New Market mine, TN.	Reopened mine on Sept. 15, recalling 110 union workers. The mine had been closed since Jan. 31, 1986. Annual capacity at the mine is about 15,000 mt zinc in concentrate.

SELECTED NEW CONTRACTS, INVESTMENTS, EXPANSIONS, AND EXPLORATION ACTIVITIES: INTERNATIONAL

COUNTRY Commodity and Company	Operation and/or Location	Notes
AUSTRALIA		
GALLIUM		
West Coast Holdings Ltd.	Brockman deposit, Kimberly, Western Australia.	Plans to conduct a feasibility study on the construction of a plant to produce 25,000 kg/yr of gallium and 300 mt/yr of yttrium oxide. The plant is expected to use an advanced hydrometallurgical leaching technique to extract the gallium and yttrium oxide, as well as other metals including rare earths, tantalum, zirconium, and columbium. The study is expected to be completed in mid-1987.
GOLD		
BHP Co. Ltd.	Australian gold operations.	Announced plans to increase its Australian gold production sixfold to 300,000 tr oz/yr by 1990. BHP will expand exploration nationwide plus increase the efficiency and capacity of its existing operations in Western Australia.

TIN		
Promin Holdings Ltd. and Laser-Tech Australia, Ltd.	Cairns, North Queensland.	Plans to invest $2A million to construct a new tin smelter, which will produce byproduct columbium- and tantalum-bearing tin slags.
CANADA		
BERYLLIUM AND RARE EARTHS		
Highwood Resources Ltd. and Hecla Mining Co. of Canada Ltd., a subsidiary of Hecla Mining Co. (U.S.).	Thor Lake, near Yellowknife, Northwest Territories.	Announced a joint venture to develop Highwood's Thor Lake property for its beryllium and rare earth values. Hecla reportedly agreed to reimburse Highwood for 50% of its prior expenditures and provide financing to bring the mine and downstream facilities into production. Reserves at the deposit were estimated to be 1.8 million st, grading 0.85% beryllium oxide.
GOLD AND SILVER		
Total Erickson Resources Ltd.	Mount Skukum Mine, near White Horse, Yukon Territory.	Mine officially opened in August. Gold production began in early February, with about 55,000 tr oz projected for 1986.
MAGNESIUM		
Chromasco, Division of Timminco.	Haley, Ontario.	Plans to increase primary magnesium capacity by 50% to 16,500 mt/yr over the next 4 yr. Over the next year, Chromasco will be able to increase primary magnesium production by 20% by switching existing facilities from strontium and calcium production.
NICKEL		
Hudson Bay Mining and Smelting Ltd.	Namew Lake deposit. Flin Flon, Manitoba.	Began an exploratory shaft in the nickel deposit (2.85 million mt of 2.4% nickel and 0.9% copper) discovered in 1985. Signed a letter of intent to form a joint venture with Finland's Outokumpu Oy to develop the deposit.
Sherritt Gordon Mines Ltd.	Fort Saskatchewan refinery, Alberta.	The refinery is undergoing modification so that it can fill the contract with the Royal Canadian Mint for new $1 coins made from bronze-coated nickel blanks.
CHINA		
MAGNESIUM COMPOUNDS		
Liaoning Magnesite Co.	Haicheng magnesite mine, Liaoning Province.	Plans to construct a plant to produce 50,000 mt/yr of high purity magnesite to be completed in 1988.
CUBA		
CHROMITE		
Ministry of Basic Industries.	Concentrate plant in Holguin Province.	Opened in August, a new, fully automated plant capable of processing 50,000 mt/yr of chromite ore to produce 37,400 mt/yr of concentrate. Built by Czechoslovakia at a cost of $12 million, the new plant will replace an obsolete facility. Ore is from the Merceditas Mine in Holguin Province. A new chromite mine at Amores in Holguin Province is scheduled to open in 1987 and produce 10,000 mt/yr of ore. Cuba's projected full-capacity output of 310,000 mt/yr of chromite to be reached between 1986 and 1990 indicates that the old plant may not be decommissioned immediately.
FINLAND		
COPPER		
Outokumpu Oy.	Viscaria Mine near Kiruna, Sweden.	Finalized a deal to purchase the Viscaria Mine from Luossavaara Kiirunavaara AB (LKAB) in August. The mine produces about 120,000 mt/yr of concentrates containing 28,000 mt of copper. Outokumpu is anxious to secure foreign sources of metal concentrates to offset depletion of its own reserves in the near future. Otokumpu had been purchasing 1/3 of the mine's output.
GERMANY, FEDERAL REPUBLIC OF		
STEEL		
Arbed Saarstahl and Dillinger Hüttenwerke.	Saarland.	Merger between Arbed Saarstahl and Dillinger Hüttenwerke has been cleared by the Saar and Federal Government. The plan calls for Arbed Sa, Saarstahl's Luxembourg parent, to retain 24% of the company, with the remaining 76% going to Dillinger. No date has been set, but the merger may take place within 1-1/2 to 2 yr, and by the early 1990's, Saarstahl would be fully integrated with Dillinger.
Westig GmbH.	Specialty steelmaker.	Purchased final 25% of its own shares from Sweden's Fagersta, returning the company to West German ownership. The management bought the initial 75% share in 1984. Westig produces specialty steel, narrow strip, and bright bars. Some 65% of Westig's total turnover is derived from exports, the major buyers being Switzerland, France, and the United States.

JAPAN		
TITANIUM		
Nippon Kokan K.K.	Fukuyama Works, heavy plate rolling mill, Hiroshima Prefecture.	Nippon Kokan has reportedly developed a new titanium-clad steel plate for sale to manufacturers of chemical tankers, pressure vessels, and other offshore structural equipment where high corrosion resistance is needed. The cost of the titanium-clad steelplate would be 50% to 75% less than for pure titanium plate. The titanium cladding is applied with a hot-rolling process, rather than the explosive-bonding process commonly used for bonding titanium to steel.
NORWAY		
ALUMINUM		
Norsk Hydro AS.	Smelters and semifabrication in Norway and other countries.	Merged in September with Government-owned AS Ardal og Sunndal Verk (ASV), another Norwegian aluminum producer. Included in the merger are 5 European extrusion plants being purchased from Alcan. Norsk Hydro, 51% Government-owned, now owns 70% of the new company. Employment is expected to be at least 12,000, annual turnover about $2 billion, and primary aluminum capacity about 700,000 mt/yr.
TITANIA SLAG AND PIG IRON		
Ilmenittsmelterverket AS.	Smelter at Sauda.	New plant is expected to go on-stream by yearend with a rated capacity of 200,000 mt/yr of titania slag and 108,000 mt/yr of pig iron.
ZINC		
Norzink AS.	Smelter-refinery complex at Odda.	Completed a 20% expansion project to 110,000 mt/yr zinc capacity. Expected to be operating at full capacity by the end of October 1986. Total cost of the expansion was about $60 million.
PERU		
LEAD		
Fundicion de Concentrados S.A.	Smelter at Sayan, Lima Dept.	Inaugurated Peru's 1st privately owned lead smelter in August. The plant can treat 24,000 mt/yr of concentrate and produce as much as 12,000 mt of refined lead and 42 mt of refined silver in bars.
SWEDEN		
FERROCHROMIUM		
SwedeChrome AB.	Smelter at Malmö.	Production of pig iron began in August. Full capacity operation is expected by yearend 1986. The smelter is to be run using pig iron for the 1st 3 months. 2 identical shaft furnaces have been installed, each powered by 4 6-MW plasma torches. Powdered chromium ore concentrate, coal reductant and silica are fed into the plasma furnace. In addition to ferrochromium, the plant is to produce hot water and surplus gas for the local district heating authority.
STEEL		
SKF Steel AB (Sweden) and Ovako Oy AB (Finland)	Semifabrication plant, Hallefors, Sweden, and Billet plant at Imatra, Finland.	Merged the companies into new company, Ovako Steel AB, based in Stockholm, in a 50-50 joint equity arrangement. Management of the enterprise projected to have a turnover of $800 million in its 1st full operating year, is the responsibility of Ovako Oy AB. The company plans to produce a total of 1.2 million mt of speciality steel in 1986 and employ over 7,000 workers. Ovako has been the world leader in continuously cast steel production and posted healthy profits for several years. SKF, in contrast, recorded significant losses in 1985.
TAIWAN		
CAUSTIC SODA AND CHLORINE		
Joint venture: PPG Industries (U.S., 53%), China Chemical Development Corp. (CPD--Taiwan, 40%), and Asahi Glass Co., Ltd. (Japan, 7%).	Chlor-alkali plant, Taiwan.	The joint venture is being set up to produce caustic soda and chlorine in Taiwan. The chlor-alkali plant will use the ion-exchange membrane process instead of the mercury cells currently being used by CPDC and other local producers. PPG Industries is the 2d largest producer of caustic soda and chlorine in the United States.
UNITED KINGDOM		
TIN		
Rio Tinto Zinc Corp. PLC (RTZ).	Tin mines, Cornwall.	The Government agreed on Aug. 3 to provide the Cornish tin mines with $40 million in interest-free and guaranteed loans. The loans, to be used over a 5-yr period, are to help reduce costs in order to remain competitive in the world market and to increase production to about 6,000 mt/yr of tin. PLC said they would have had to close if assistance had not been granted.

SELECTED CLOSINGS, POSTPONEMENTS, LAYOFFS, AND PRODUCTION DECREASES: UNITED STATES

Commodity and Company	Operation and/or Location	Notes
ALUMINUM		
The Aluminum Co. of America (Alcoa).	Rockdale, TX, and Massena, NY.	Announced the permanent closing of 144,000 mt/yr smelting capacity, bringing the total to 274,000 mt of capacity permanently closed since announcing in December 1985 its plan to close 350,000 mt of capacity. Involved in Alcoa's latest closings are 105,000 mt/yr capacity at the 31,000-mt/yr Rockdale, TX, smelter and 39,000 mt/yr capacity at its 205,000-mt/yr Massena, NY, smelter. Alcoa permanently closed its 110,000-mt/yr Vancouver, WA, smelter in early June 1986, and its 15,000-mt/yr Palestine, TX, experimental smelter in December 1985. The current closings affect idled capacity and will not result in any additional employee layoffs. The remaining 76,000 mt/yr of Alcoa's capacity cutback is likely to be in Suriname, South America. The cutbacks reduce U.S. smelting capacity to about 4.27 million mt/yr, down from 5.0 million mt/yr in 1983.
Hall Aluminum Co.	Secondary Aluminum Smelter in Chicago Heights, IL.	Filed for protection under Chapter 11 of the Federal Bankruptcy Code. Had been producing secondary aluminum ingots at a rate of 2.5 million lb/month. The company employed 70 persons. Company plans call for an orderly liquidation of the firm, and creditors are to be paid off at a rate of 35¢ to 40¢ on the dollar owed them.
Kaiser Aluminum & Chemical Corp.	Trentwood plant, Spokane, WA.	Announced plans to lay off 28 maintenance workers as a result of the company's $22 million loss in the 1st half of 1986.
ALUMINUM CASTINGS AND IRON CASTINGS		
General Motors Corp.	Saginaw, MI, and Massena, NY.	Plans to phase out production at the Saginaw nodular iron plant by the summer of 1988, eliminating 1,747 jobs. A gradual phaseout of operations at the Massena aluminum castings plant began at the end of August, which will cost nearly 1,300 jobs. Forecasts indicate they will need less foundry capacity in the future. Last year GM closed engine block foundries in Pontiac, MI, and Tonawanda, NY.
IRON AND STEEL		
Armco Inc.	Reserve Mining Co., Babbitt and Silver Bay, MN.	Filed Chapter 11 proceedings for its subsidiary, First Taconite Corp., effectively placing the Reserve Mining Co. partnership under court protection. The company stated it could not economically produce iron ore pellets without a partner to share fixed costs and would not be able to meet its financial obligations. Reserve Mining suspended taconite operations indefinitely on July 21, affecting some 750 workers.
Cleveland-Cliffs Iron Co.	Tilden Mine, Ishpeming, MI.	Shut down iron ore operations on Aug. 9 for at least 12 wk. About 650 to 700 of Tilden's 750 employees were laid off.
Judson Steel Corp.	Steel minimill, Emeryville, CA.	Permanently closed its steel minimill, which produced 130,000 st/yr of bar, in Emeryville, CA, at the beginning of September. The closing leaves only a Japanese-owned minimill still producing raw steel in California. As recently as 1981, 5 plants in California produced over 2.6 million st of raw steel.
LTV Corp.	Bar plants and mills, Chicago, IL, Hammond, IN, Youngstown, OH, and Campbell, OH.	Shut down indefinitely or idled half of its barmaking capacity and many of its mills in August and September because of weak demand. About 1,785 workers were laid off.
Pickands Mather & Co.	Erie Mining Co., Reserve Mining Co., McKinley Mine, and Hibbing Taconite Co., MN.	Put up for sale by the parent company, Moore McCormack Resources Inc., because of low likelihood for profitability in its steel-related assets. The company manages the Erie, Reserve, and McKinley properties for LTV Corp. and its partners. Pickands also manages Hibbing Taconite, in which it is a part owner along with Bethlehem Steel Corp. and Stelco Inc. The sale would also include Interlake Steamship Co., a Great Lakes shipping company, Moore McCormack Bulk Transport Inc., an ocean transport firm, and Globe Metallurgical Inc., a maker of silicon metal and ferroalloys.
LEAD		
St. Joe Lead Co.	Herculaneum, MO.	Laid off 75 of its 509 employees at the Herculaneum smelter in late August. Plummeting lead prices were cited as the reason. Of the 75 workers laid off, 12 were salaried employees whose removal was a permanent action. The 63 affected hourly employees are to be recalled periodically. The Herculaneum smelter will operate at near-normal production levels of 204,000 mt/yr for fiscal year 1987 (beginning Nov. 1, 1986). A St. Joe official stated that the increased number of imported products, including automobile batteries and other lead parts, caused the most recent price drops. Excess domestic output of 91,000 mt/month of refined lead has also contributed to low prices.

LITHIUM		
Foote Mineral Co. (controlled by Newmont Mining Corp.).	Kings Mountain, NC.	Seeking a buyer for the company at the request of Newmont. The company is available as a whole, in part, or as a merger. Foote operates lithium ore extraction facilities in North Carolina and Nevada.
MOLYBDENUM		
AMAX Inc.	Climax and Henderson Mines, CO.	Announced in mid-August a reduction of 115 employees at the Henderson Mine and that employment at the Climax Mine would be reduced by 300 people Oct. 1, a cut of about 60%. Production at Climax will be reduced from 21,000 st/d to 6,000, and at Henderson from 32,500 st/d to 27,000. After the cutbacks, Climax will employ 200 and Henderson 700. The cutbacks are the result of a worldwide glut of molybdenum, which is used mainly as a hardening alloy in steel. Current market prices range about $2.95 to $3.05/lb of molybdenum oxide, down nearly 100% since 1980.
Cyprus Minerals Co.	Thompson Creek Mine, Custer County, ID.	Shelved plans to increase overburden stripping due to cost. Mine will continue to operate under the 2-1/2-yr plan begun in January 1986, with shutdown planned at the end of that time unless the molybdenum market improves. A labor force reduction is expected in the 3d quarter of 1987.
MULLITE (SYNTHETIC)		
A. P. Green Refractories Co.	Philadelphia, PA, and Pueblo, CO.	Closing both plants at yearend affecting 165 workers. The firm produced alumina firebrick, silicon carbide, zircon, and mullite refractories. The closings were attributed to the oversupply of refractories because of the depressed steel industry.
NICKEL		
M. A. Hanna Co.	Mine and plant, Riddle, OR.	Shut down its smelting subsidiary at Riddle, OR, in August because of slumping nickel prices. Prices have dropped about 20% since last summer, when the company began constructing a $13 million plant to produce ferronickel at Riddle using a wet-screening technology and slurry transport system. The new process has proven successful, but nickel prices have not hit the $1.90 to $2.00/lb needed for the company to operate at a profit. Average dealer prices for cathodes in August were $1.85/lb. The operation recently employed 180 workers and is the Nation's only integrated nickel mining and smelting operation. The operation has a capacity of 12,000 st/yr of nickel in ferronickel. Hanna will continue to sell ferronickel from inventories.
PHOSPHATE ROCK		
Western Cooperative Fertilizers Ltd.	Conda Partnership Mine, Caribou County, ID.	Announced closure and mothballing of phosphate mine and calcining operation jointly owned with financially troubled Beker Industries. Operations could eventually be reopened if economic conditions improve.
SALT		
PPG Industries Inc.	Natrium, WV.	Strike began on Aug. 31 by nearly 600 workers at the chemical plant after their contract expired and they rejected a new pact. The chlorine and caustic soda production facility is being run by salaried personnel.
SILVER		
Hecla Mining Co.	Consolidated Silver Project, Shoshone County, ID.	Announced stoppage of drilling at the underground joint-venture project with Coeur d'Alene mines after 6 yr of exploration because of disappointing results. Hecla provided $10 million of the $15 million spent on the project.
Sunshine Mining Co.	Sixteen-to-One Mine, Esmeralda, NV.	Halted all mining operations owing to low silver prices. Workers and equipment were transferred to a nearby gold project currently being developed.
SODIUM CARBONATE (TRONA/SODA ASH)		
General Chemical Corp., formerly Allied Chemical Co.	Green River, WY.	Laid off about 90 workers at its trona and soda ash operation in mid-August, reducing employment at the plant to about 675 workers. General Chemical is the 2d largest of the five soda ash producers in southwestern Wyoming. Employment at the 5 plants, which comprise about 90% of the Nation's soda ash capacity, has dropped from about 4,100 in 1980 to about 2,900 currently.
TUNGSTEN		
Climax Molybdenum Corp. (owned by Amax, Inc.).	Leadville, CO.	Discontinued its byproduct production of tungsten concentrates from molybdenum production because of losses resulting from tungsten prices being at the lowest-ever constant-dollar level.

SELECTED CLOSINGS, POSTPONEMENTS, LAYOFFS, AND PRODUCTION DECREASES: INTERNATIONAL

COUNTRY Commodity and Company	Operation and/or Location	Notes
AUSTRALIA		
NICKEL		
Agnew Mining Co. Pty. Ltd.	Agnew Mine.	Suspended mining on Aug. 1 at the 500,000-mt/yr mine. Production for 1983 and 1984 was 234,000 mt/yr and 203,000 mt/yr, respectively.
AUSTRIA		
IRON AND STEEL		
Voest-Alpine AG.	Various locations in Austria.	Plans to reduce employment by 9,400, or nearly 1/4, by 1990, during corporate restructuring. More than 1/2 of the lost jobs will be in the steel division.
NEW CALEDONIA		
NICKEL		
LeNickel-SLN.	Nickel smelting.	Cutting 1986 production by 2,200 st from the original target of 48,000 st because of world oversupply and low price.
SPAIN		
COPPER		
Rio Tinto Minera.	Cerro Colorado, Alfredo, and Santiago.	Announced temporary closure due to the high value of the peseta and low copper prices. The 3 mines produced about 250,000 mt of concentrates in 1985. The smelter at Huelva will continue to operate on stocks.
SPAIN		
MERCURY		
Minas de Almaden y Arrayanes.	Almaden.	Suspended ore production and spot sales temporarily.
TAIWAN		
TITANIUM DIOXIDE		
E. I. du Pont de Nemours and Co.	Titanium dioxide plant, central Taiwan.	The Government of Taiwan has temporarily blocked construction of the company's titanium dioxide plant because of local concern about pollution. Du Pont has agreed to prepare an environmental impact study by early 1987. If the study is approved, the company should be able to meet its target completion date of 1989. Construction of the proposed 60,000-mt/yr plant, located in an agricultural area in central Taiwan, is expected to cost between $100 million and $120 million.
THAILAND		
STEEL		
Siam Ferro Industry Co.	Laem Chabang, Chon Buri Province.	The direct-reduced-iron company was dissolved on June 24, abandoning plans for a 400,000-mt/yr natural gas-based plant. The high cost of the natural gas and necessary infrastructure combined with a recent deterioration of the Thai economy were the causes of the plant's demise.

MINERAL DATA SERIES

ALUMINUM

CHROMIUM

COBALT

COPPER

IRON ORE

LEAD

MANGANESE

NICKEL

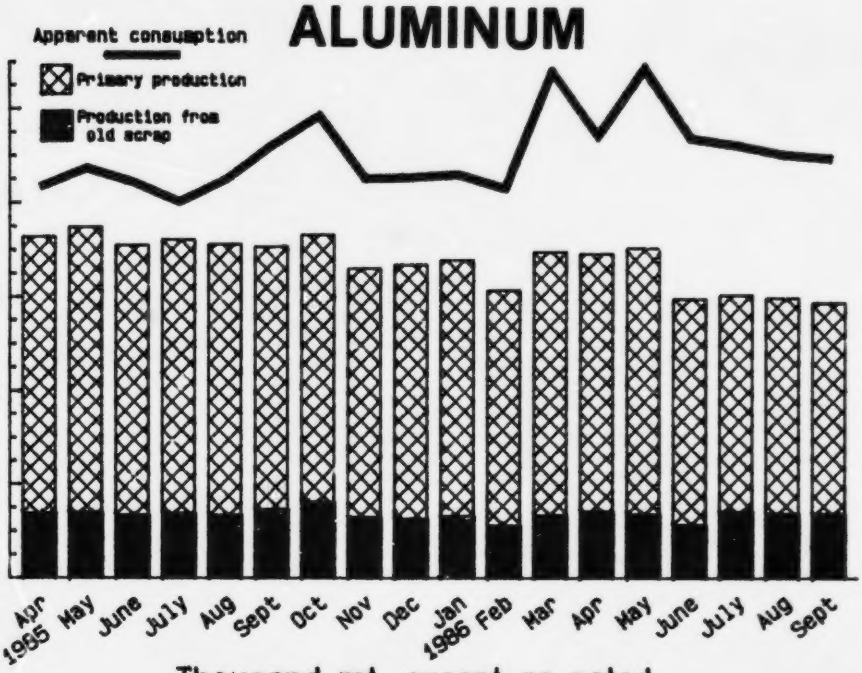
PLATINUM-GROUP METALS

STEEL

TITANIUM METAL

ZINC

ALUMINUM



Thousand mt, except as noted

Year / Month	Apparent consumption	Production: Primary	Production: From old scrap	Imports	Exports	Inventories: Private	Inventories: Government	Price (¢/lb)[3]
1981	4,615	4,489	758	848	787	2,996	2	76.0
1982	4,370	3,274	782	878	748	2,812	2	76.0
1983	5,035	3,353	820	1,091	776	2,265	2	77.8
1984	5,279	4,099	825	1,477	734	2,653	2	81.0
1985	5,172	3,500	850	1,420	908	2,343	2	81.0
1985: Apr	415	295	70	110	78	2,603	2	81.0
May	435	304	71	121	75	2,589	2	81.0
June	420	288	68	119	107	2,537	2	81.0
July	399	292	70	109	79	2,530	2	81.0
Aug	423	289	68	113	78	2,499	2	81.0
Sept	460	280	74	149	73	2,469	2	81.0
Oct	491	285	82	135	65	2,415	2	81.0
Nov	423	265	66	115	60	2,378	2	81.0
Dec	425	271	64	106	51	2,343	2	81.0
1986: Jan	428	273	67	131	45	2,341	2	81.0
Feb	413	251	57	151	47	2,340	2	81.0
Mar	538	281	68	175	34	2,292	2	81.0
Apr	469	275	72	175	33	2,312	2	81.0
May	541	284	69	202	38	2,288	2	81.0
June	466[r]	241[r]	58	198	31	2,288	2	81.0
July	459	231	72	191	27	2,296[e]	2	81.0
Aug[e]	449	230	70	177	34	2,290	2	81.0
Sept[e]	445	225	70	175	35	2,280	2	81.0

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 23, 1986.

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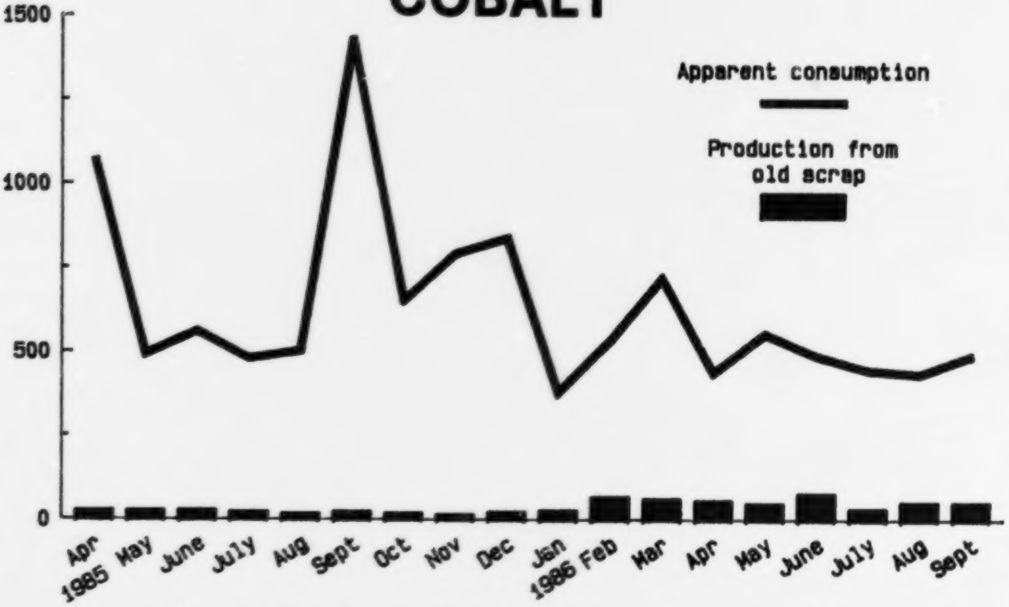
COBALT



Short tons (st) contained metal, except as noted

Year / Month		---Consumption--- Apparent	Reported	---Production--- Primary	From old scrap[1]	Imports	Exports[2]	---Inventories--- Private[3]	Government	Price ($/lb)[4]
1981		6,266	5,840	0	486	7,797	417	4,188	21,566[5]	NA
1982		5,725	4,734	0	436	6,435	300	3,733	22,866	8.56
1983		7,856	5,660	0	362	8,611	412	4,304	22,998	5.76
1984		8,948[6,8]	6,472	0	440	9,950	336	5,629	23,097	10.40
1985		NA	6,771	0	333	8,854	314	NA	26,592	11.43
1985:	Apr	1,077	503	0	33	1,103[7]	32	1,300	23,097	11.61
	May	494	486	0	33	433[7]	27	1,244	23,097	11.57
	June	564	431	0	34	547[7]	25	1,236	23,097	11.53
	July	482	352	0	29	522[7]	30	1,275	25,096	11.48
	Aug	506	403	0	24	538	33	1,297	25,096	11.45
	Sept	1,430	445	0	30	1,579	21	1,455	25,096	11.32
	Oct	655	478	0	26	650	6	1,471	25,096	11.32
	Nov	796	441	0	22	735	16	1,416	25,096	11.25
	Dec	842[6]	376	0	30	746	20	1,331	26,592	11.15
1986:	Jan	381[r]	421[r]	0	34[r]	561	81	1,464[r]	26,592	10.97
	Feb	538[r]	386	0	75[r]	469	33	1,436	26,592	10.63
	Mar	723[r]	466	0	69[r]	560	39	1,303	26,592	10.24
	Apr	440[r]	464[r]	0	64[r]	396	17	1,306[r]	26,592	9.60
	May	558[r]	414	0	56[r]	412	48	1,168[r]	26,592	8.73
	June	493	487	0	85	403	5	1,157	26,592	6.88
	July	450	385	0	40	444	16	1,175	26,592	5.20
	Aug[e]	438	433	0	60	481	13	1,265	26,592	4.02
	Sept[e]	494	433	0	60	465	32	1,265	26,592	5.66

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 21, 1986.

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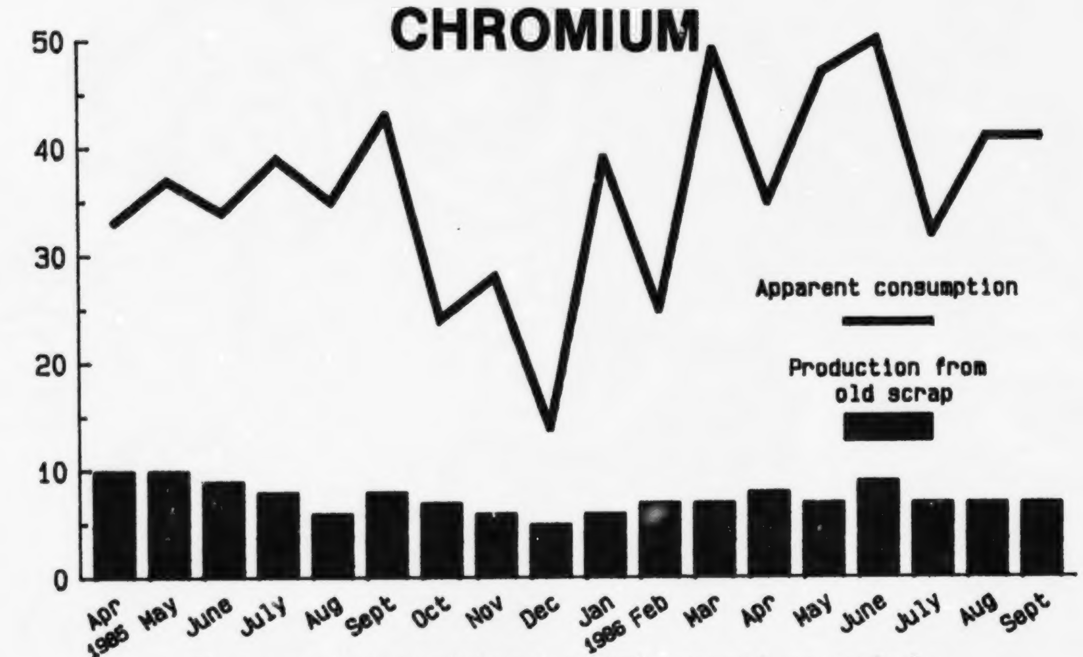

Thousand st contained metal, except as noted

Year/Month	Consumption		Production				Inventories		
	Apparent	Reported[1]	Primary	From old scrap	Imports[3]	Exports[3]	Private[4]	Government[5]	Price ($/mt)[6]
1981	510	349	0	55	508	52	251	1,325	51-55
1982	319	232	0	48	239	10	209	1,325	48-52
1983	329	301	0	77	231	13	175	1,325	48-52
1984	437	355	0	81	332	25	118	1,325	48-52
1985[p]	378	338	0	94	304	26	112	1,325	42-45
1985: Apr	33	29	0	10	20	2	110	1,325	48-52
May	37	31	0	10	24	0	107	1,325	40-42
June	34	29	0	9	35	0	118	1,325	40-42
July	39	26	0	8	34	1	120	1,325	40-42
Aug	35	25	0	6	26	0	117	1,325	40-42
Sept	43	26	0	8	49	19	112	1,325	40-42
Oct	24	26	0	7	16	0	110	1,325	40-42
Nov	28	22	0	6	27	6	109	1,325	40-42
Dec	14	27	0	5	14	0	114	1,325	40-42
1986: Jan	39	29	0	6	54	1	133	1,325	40-42
Feb	25	25	0	7	34	0	149	1,325	40-42
Mar	49	27	0	7	30	0	138	1,325	40-42
Apr	35	28	0	8	18	0	127	1,325	40-42
May	47	29	0	7	50	1	137	1,325	40-42
June	50	27	0	9	49	6	138	1,325	40-42
July	32	23	0	7	20	6	127	1,325	40-42
Aug[e]	41	27	0	7	36	2	127	1,325	40-42
Sept[e]	41	27	0	7	36	2	127	1,325	40-42

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 22, 1986.

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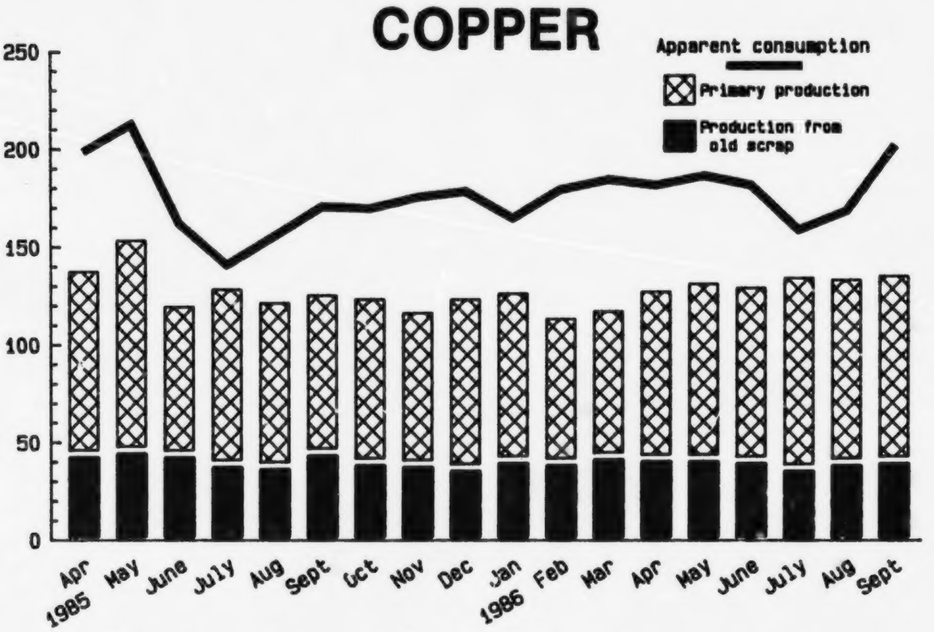

Thousand mt contained metal, except as noted

Year / Month		Apparent consumption	Production[1] Primary	Production[1] From old scrap	Imports[2]	Exports[2]	Inventories Private[3]	Inventories Government	Price[4] (¢/lb)
1981		2,271	1,544	592	331	24	465	20	84.2
1982		1,762	1,227	518	258	31	676	20	72.8
1983		2,014	1,182	449	460	81	672	20	76.5
1984		2,106	1,164	461	445	91	544	20	66.8
1985		2,153	1,051	503	378	38	291	20	66.9
1985:	Apr	198	95	44	22	2	394	20	70.3
	May	212	102	46	27	10	346	20	69.9
	June	161	77	44	42	3	345	20	67.1
	July	140	91	39	26	4	357	20	66.8
	Aug	155	85	38	25	5	345	20	66.3
	Sept	170	82	45	33	1	335	20	65.7
	Oct	169	85	40	19	1	310	20	66.7
	Nov	175	79	39	43	1	296	20	66.3
	Dec	178	88	37	49	1	291	20	68.0
1986:	Jan	164	87	41	50	1	304	20	69.9
	Feb	179	75	40	41	1	280	20	68.2
	Mar	194	76	43	46	1	250	20	70.2
	Apr	181	87	42	41	1	239	20	68.8
	May	186	91	42	53	1	238	20	67.0
	June[e]	181	90	41	32	1	218	20	67.5
	July[e]	158	99	37	40	1	235	20	63.5
	Aug[e]	168	95	40	40	2	240	20	62.4
	Sept[e]	201	96	41	45	1	220	20	64.8

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 22, 1986.

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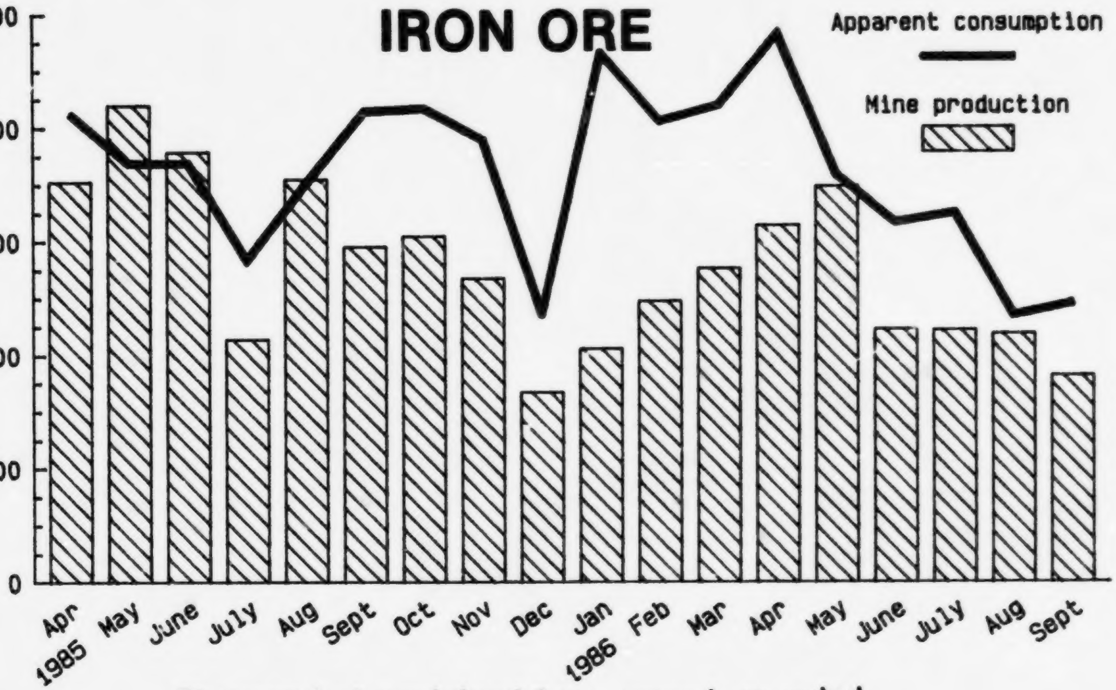

Thousand st contained iron, except as noted

Year / Month		—Consumption— Apparent[2]	 Reported[2]	Mine production[3]	Imports	Exports	Industry stocks[4]	Price ($/st)[5]
1981		64,800	67,000	52,400	20,000	3,900	42,500	71.88
1982		41,800	39,300	25,400	10,250	2,300	34,100	71.88-77.20
1983		42,900[6]	43,400	27,100	9,400	2,700	23,200	71.88-77.59
1984		45,800	47,000	37,100	12,100	3,600	23,000	58.93-77.59
1985		44,400	45,300	35,100	11,100	3,600	21,200	51.79-77.59
1985:	Apr	4,130	4,020	3,535	682	141	20,056	58.93-77.59
	May	3,690	4,307	4,207	615	389	20,799	58.93-77.59
	June	3,696	3,854	3,798	925	478	21,348	58.93-77.59
	July	2,841	3,729	2,148	933	419	21,169	58.93-77.59
	Aug	3,518	3,694	3,558	1,178	400	21,987	58.93-77.59
	Sept	4,155	3,500	2,963	2,109	580	22,324	51.79-77.59
	Oct	4,179	3,629	3,055	920	262	21,858	51.79-77.59
	Nov	3,899	3,621	2,686	1,068	364	21,349	51.79-77.59
	Dec	2,368	3,622	1,682	893	367	21,189	51.79-77.59
1986:	Jan^e	4,660	3,901	2,067	912	9	19,499	51.79-77.59
	Feb^e	4,061	3,710	2,487	831	0	18,756	51.79-77.59
	Mar^e	4,202	3,933	2,774	813	102	18,039	51.79-77.59
	Apr^e	4,830	3,864	3,152	1,019	156	17,224	51.79-77.59
	May^e	3,585	3,809	3,495	1,217	381	17,970	51.79-77.59
	June^e	3,170	3,316	2,237	1,357	421	17,973	51.79-77.59
	July^e	3,260	2,896	2,229	1,200	281	17,861	51.79-77.59
	Aug^e	2,352	3,044	2,197	790	348	18,148	51.79-77.59
	Sept^e	2,462	2,885	1,829	1,415	504	18,426	51.79-77.59

Apparent consumption = mine production + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 21, 1986.

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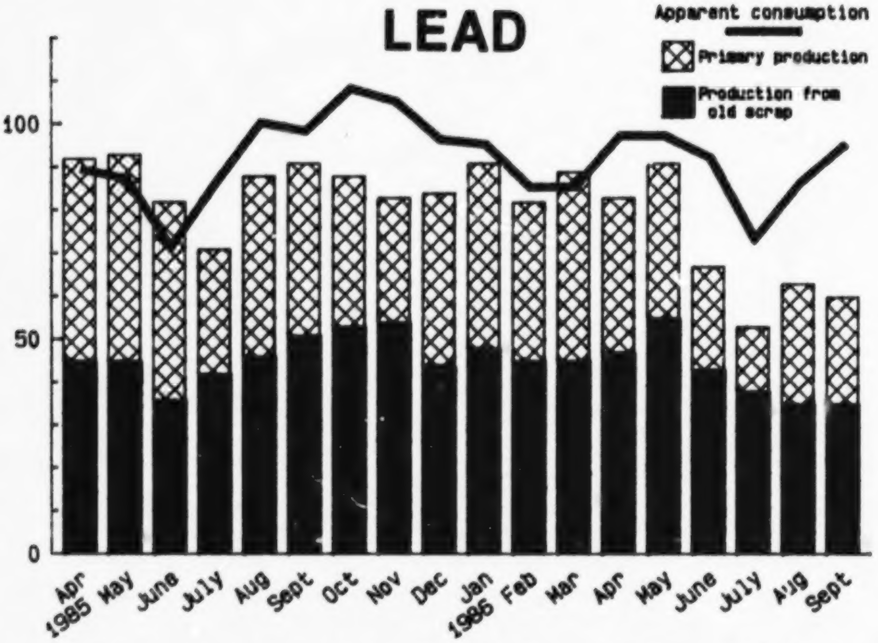

Thousand mt contained metal, except as noted

Year / Month		Apparent consumption	Production: Primary	Production: From old scrap	Imports	Exports	Inventories: Private	Inventories: Government	Price (¢/lb)
1981		1,132	498	578	100[r]	23	203	545	36.53
1982		1,109	517	521	95	56	171	545	25.54
1983		1,136	515	452	177	20	159	545	21.68
1984		1,152[r]	396[r]	586[r]	163	7	145	545	25.55
1985		1,113[r]	487	552[r]	133[r]	27	177	545	19.07
1985:	Apr	89[r]	47	45[r]	11	1	156	545	19.92
	May	87[r]	48	45[r]	9	1	170	545	20.11
	June	71[r]	46	36[r]	8	0	189	545	19.05
	July	86[r]	29	42[r]	8	1	181	545	18.88
	Aug	100[r]	42	46[r]	11	7	173	545	19.10
	Sept	98[r]	40	51[r]	12	11	167	545	19.20
	Oct	108[r]	35	53[r]	10	2	155	545	18.93
	Nov	105[r]	29	54[r]	14	0	147	545	19.05
	Dec	96	40	44	12	1	146	545	18.97
1986:	Jan	95[r]	43	48[r]	10	1	151	545	18.35
	Feb	85[r]	37	45[r]	12	1	159	545	17.79
	Mar	85[r]	44	45[r]	10	1	172	545	18.20
	Apr	97[r]	36	47[r]	9	1	166	545	18.73
	May	97[r]	36	55[r]	10	1	169	545	19.34
	June	92[r]	24	43[r]	12	1	155[r]	545	22.07
	July	73[r]	15[r]	38[r]	13[r]	3[r]	145[r]	545	21.94
	Aug	86	28	35	10	1	.31	545	22.42
	Sept[e]	95	25	35	10	1	105	545	23.43

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 22, 1986.

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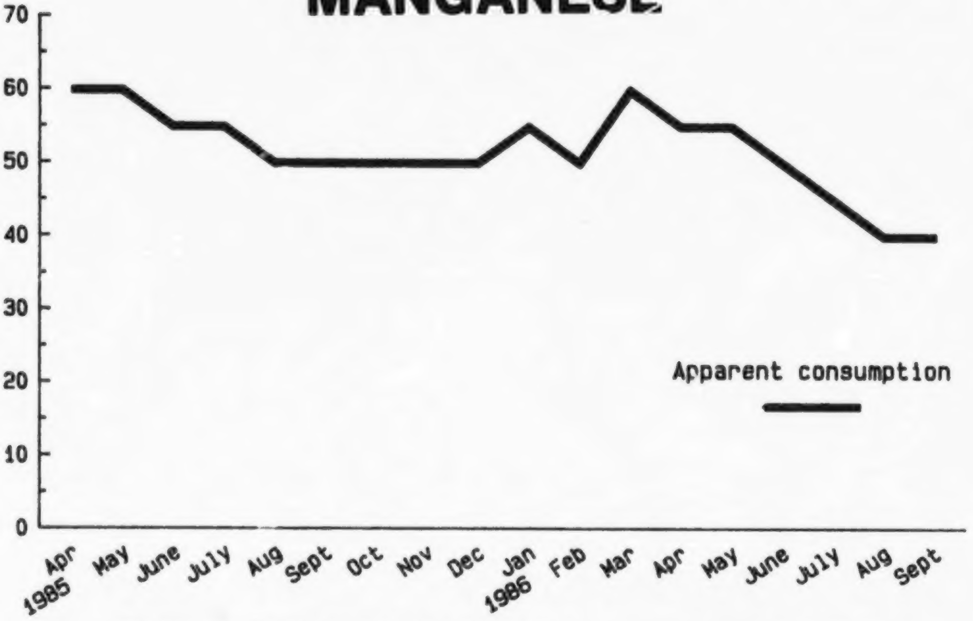
MANGANESE



Thousand st contained metal, except as noted

Year / Month		Apparent consumption	Production		Imports[2]	Exports	Inventories		Price
			Primary[1]	From old scrap			Private[3]	Govern-ment	($/LTU)[4]
1981		1,027	24	0	916	49	702	2,169	1.72
1982		672	4	0	541	27	576	2,141	1.58
1983		668	4	0	542	27	462	2,206[5]	1.38
1984		627	11	0	606	43[6]	420[5]	2,197	1.42
1985		698	2	0	609	44[6]	380	2,106	1.43
1985:	Apr	60	0	0	84	2	267	2,171	NA
	May	60	0	0	25	8	235	2,160	NA
	June	55	0	0	45	3	229	2,153	NA
	July	55	0	0	65	1	239	2,152	NA
	Aug	50	0	0	40	4	225	2,152	NA
	Sept	50	0	0	35	6	244	2,112	NA
	Oct	50	0	0	59	2	256	2,107	NA
	Nov	50	0	0	69	1	275	2,106	NA
	Dec	50	0	0	39	5	259	2,106	NA
1986:	Jan	55	0	0	67	6	281	2,090	NA
	Feb	50	0	0	79	1	311	2,088	NA
	Mar	60	0	0	45	1	296	2,087	NA
	Apr	55	0	0	68	1	315	2,080	NA
	May	55	0	0	36[r]	3	293[r]	2,080	NA
	June	50	0	0	41	4	281	2,079	NA
	July	45	0	0	55	1	288	2,081	NA
	Aug[e]	40	0	0	55	2	301	2,081	NA
	Sept[e]	40	0	0	55	2	317	2,078	NA

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 8, 1986.

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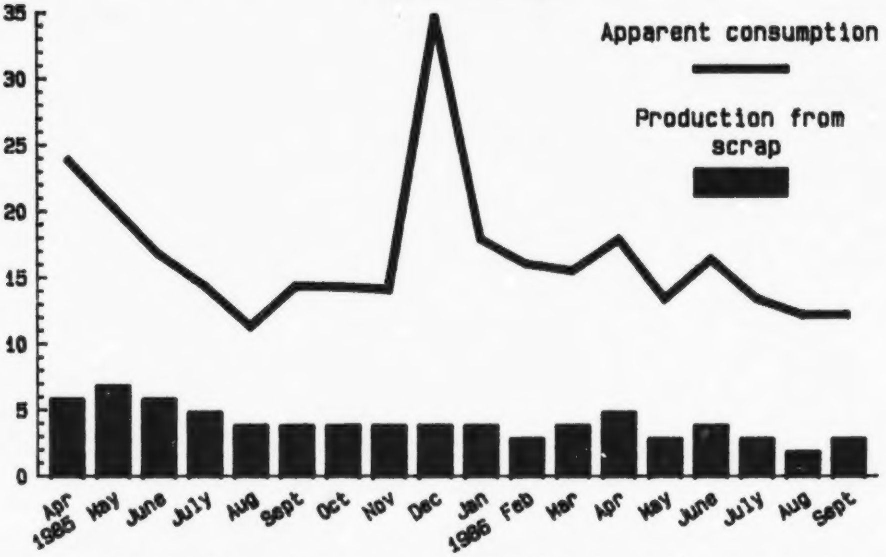
NICKEL



Thousand st contained metal, except as noted

	--Consumption--		--Production--				------Inventories------			---Price[6] ($/lb)---	
Year / Month	Appar.	Rptd.[1]	Primary[2]	From scrap[3]	Imports	Exports[4]	Consumer	Producer[5]	Government	Producer	U.S. spot
1981	206	145	10	52	209	20	23	100	32	3.43	2.67
1982	181	104	3	43	130	37	19	62	32	3.20	2.24
1983	202	128	W	51	152	23	20	39	32	3.20	2.20
1984	218	137	10	58	177	28	21	37	32	3.20	2.22
1985	219	120	5	57	158	22	19	13	37	3.20	2.26
1985: Apr	24.1	10	NA	6	18	1.6	12	NA	32	3.20	2.46
May ...	20.5	10	NA	7	15	1.8	12	NA	32	3.20	2.51
June ..	16.9	9	NA	6	13	1.8	12	NA	32	3.20	2.50
July ...	14.5	8	0	5	11	2.4	11	NA	32	3.20	2.35
Aug ...	11.4	8	0	4	7	1.9	9	NA	32	3.20	2.32
Sept ...	14.5	8	0	4	16	2.0	9	NA	37	3.20	2.17
Oct	14.4	8	NA	4	12	1.4	9	NA	37	3.20	2.02
Nov ...	14.2	7	NA	4	12	.3	9	NA	37	3.20	1.90
Dec ...	34.7	7	NA	4	15	.4	17	13	37	3.20	1.93
1986: Jan	18.0	9	NA	4	11	.2	14	NA	37	3.20	1.90
Feb	16.1	9	NA	3	12	.5	13	NA	37	3.20	1.88
Mar ...	15.6	9	NA	4	11	.7	11	NA	37	3.20	1.92
Apr	18.0	9	NA	5	13	.2	11	NA	37	3.20	1.89
May ...	13.5	8	NA	3	11	.2	11	NA	37	3.20	1.94
June ..	16.5	8	NA	4	11	.2	9	NA	37	3.20	1.95
July ...	13.5	6	NA	3	11	.3	9	NA	37	3.20	1.88
Aug[e] ...	12.3	5	NA	2	10	.2	8	NA	37	3.20	1.85
Sept[e] ...	12.3	6	NA	3	10	.2	9	NA	37	3.20	1.80

Apparent consumption = primary production + production from scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 16, 1986.

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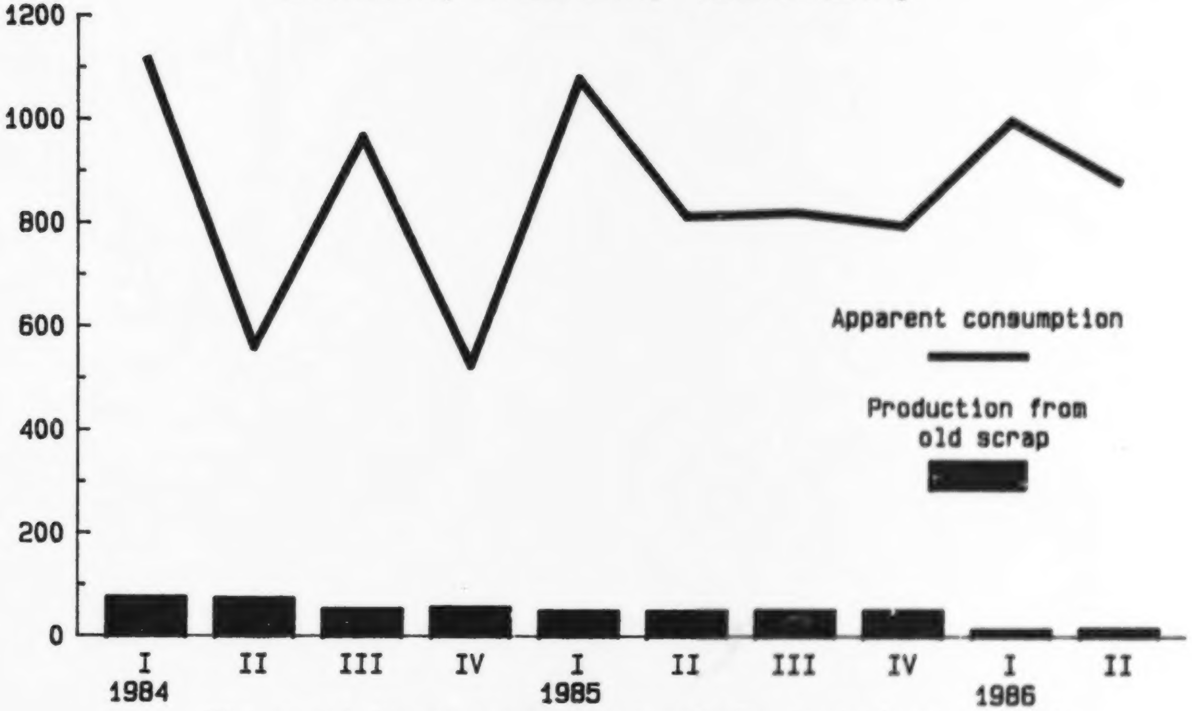
PLATINUM-GROUP METALS
(Platinum, Palladium, Iridium, Osmium, Rhodium, Ruthenium)



Thousand tr oz contained metal, except as noted

Year / Qtr	Apparent consumption	Production[1] Primary	From old scrap[2]	Imports[3]	Exports[3]	Inventories Private[4]	Government	Price ($/tr oz)[5] Pt	Pd
1981	2,445	7	392	2,846	855	918	1,725	475	130
1982	1,820	9	344	2,489	827	1,107	1,731	475	110
1983	2,482	9	303	3,207	1,197	943	1,735	475	130
1984	3,312	24	340	4,454	1,121	1,319	1,744	475	147
1985	3,473	5	259	3,969	885	1,191	1,747	475	127
1984: I	1,120	NA	80	1,313	273	901	1,735	475	137
II	563	NA	78	1,095	229	1,282	1,735	475	150
III	968	NA	57	1,177	261	1,287	1,735	475	150
IV	528	NA	61	869	356	1,324	1,744	475	150
1985: I	1,080	NA	54	1,148	310	1,133	1,747	475	148
II	815	NA	54	884	232	1,024	1,747	475	120
III	824	NA	55	965	160	1,060	1,747	475	120
IV	797	NA	55	971	183	1,106	1,747	475	120
1986: I	1,001	NA	18	1,191	227	1,087	1,747	475	120
II	883[r]	NA	21[r]	1,046	170	1,101	1,747	475	120

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 21, 1986.

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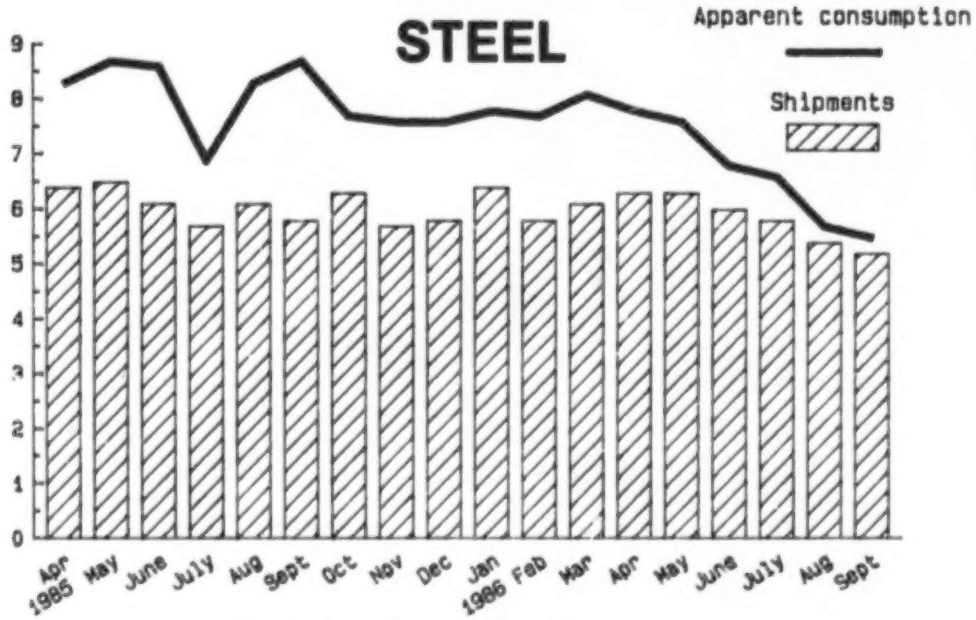

Million st metal, except as noted

Year / Month		STEEL MILL PRODUCTS[1] Production of raw steel[2]	Apparent consumption	Shipments[2]	Imports[3]	Exports[3]	Private inventories[4] Steel mill[5]	Consumer & service center	Price ($/st)[6]
1981		120.8	106.0	88.4	19.9	2.9	18.7	11.3	484
1982		74.6	78.8	61.6	16.5	1.8	13.4	8.8[7]	505
1983		84.6	81.6	67.6	17.0	1.2	12.8	11.1	524
1984		92.5	98.0	73.7	26.2	1.0	13.6	12.0[8]	545
1985		88.3	96.0	73.0	24.3	.9	13.6	9.9	552
1985:	Apr	7.9	8.3	6.4	1.9	.1	14.0	11.0	552
	May	7.8	8.7	6.5	2.0	.1	13.9	10.7	552
	June	7.3	8.6	6.1	2.4	.1	13.7	10.5	552
	July	7.0	6.9	5.7	1.6	.1	13.9	10.8	552
	Aug	7.1	8.3	6.1	2.0	.1	13.7	10.5	552
	Sept	6.9	8.7	5.8	2.5	.1	13.6	10.1	552
	Oct	7.4	7.7	6.3	1.3	.1	13.3	10.0	552
	Nov	7.1	7.6	5.7	1.7	.1	13.4	9.6	552
	Dec	6.7	7.6	5.8	2.1	.1	13.6	9.9	552
1986:	Jan	7.7	7.8	6.4	1.7	.1	13.4	10.2	492
	Feb	7.2	7.7	5.8	2.0	.1	13.5	10.3	492
	Mar	7.9	8.1	6.1	2.0	.1	13.5	10.2	492
	Apr	7.8	7.8	6.3	1.6	.1	13.6	10.3	492
	May	7.6	7.7[r]	6.2	1.6	.1	13.7	10.4[r]	492
	June	6.7	7.5[r]	6.0[r]	1.7[r]	.1	13.6[r]	10.5[r]	497
	July	6.5	7.0[r]	5.8[r]	2.1[r]	.1	13.3[e]	11.3[e]	497
	Aug	5.7	7.2	5.4	1.5	.1	13.2[e]	10.9[e]	497
	Sept[e]	[illegible]	7.1	5.2	1.6	.1	13.1	10.5	499

Apparent consumption = shipments + (imports - exports) + (beginning inventories - ending inventories). (Consumer and service center inventories only.)

See footnotes at end of section.
Data prepared October 21, 1986.

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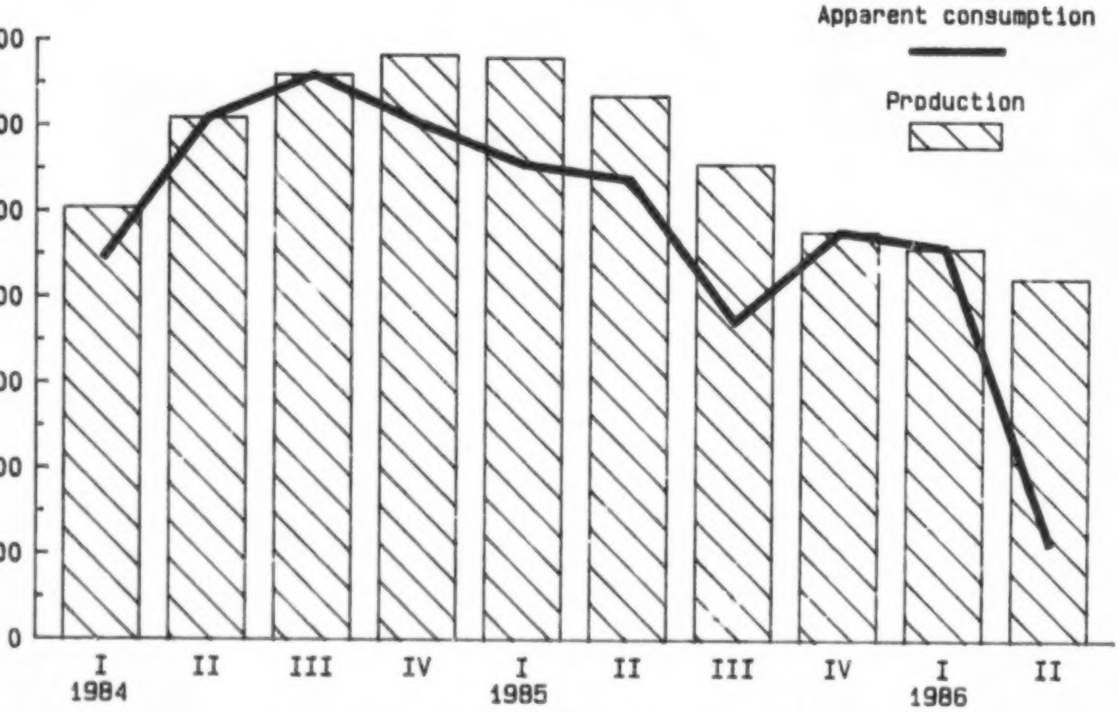
TITANIUM METAL



Short tons (st), except as noted

Year / Qtr		Apparent consumption	Production: Primary	Production: From old scrap	Imports	Exports	Inventories: Sponge[e]	Inventories: Other[e,2]	Inventories: Government	Price ($/lb)[3]
1981		23,891	26,506	300	11,639	9,643	3,720	14,083	32,331	7.65
1982		12,521	15,639	300	3,795	8,103	3,350	13,563	32,331	5.55
1983		7,857	13,966	300	3,785	8,061	3,136	15,900	32,331	5.55
1984		21,682	24,326	300	5,533	7,333	3,147	17,033	32,470[5]	5.55
1985		18,356	23,257	300	5,478	10,384	4,755	15,720	36,831[5]	5.55
1984:	I	4,470	4,988	75	1,221[4]	1,828	3,312	15,710	32,331	5.55
	II	5,025	6,035	75	1,700[4]	2,142	3,553	16,112	32,331	5.55
	III	6,135	6,538	75	1,367[4]	1,450	3,835	16,225	32,331	5.55
	IV	6,052	6,765	75	1,250[4]	1,913	3,147	17,033	33,470[5]	5.55
1985:	I	5,569	6,736	75	1,190	2,644	3,419	16,549	33,069[5]	5.55
	II	5,392	6,295	75	1,775	2,688	3,985	16,048	35,826[5]	5.55
	III	3,741[e]	5,505	75	1,411	2,412	4,639	16,232	36,831[e,5]	5.55
	IV	3,654	4,721	75	1,102	2,640	4,755	15,720	36,831[e]	5.55
1986:	I	4,164	4,530	75	1,407	2,523	3,930	15,870	36,831	3.75 - 3.95
	II	1,147	4,177	75	1,481	4,507	3,576	16,303	36,831	3.75 - 3.95

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared September 21, 1986.

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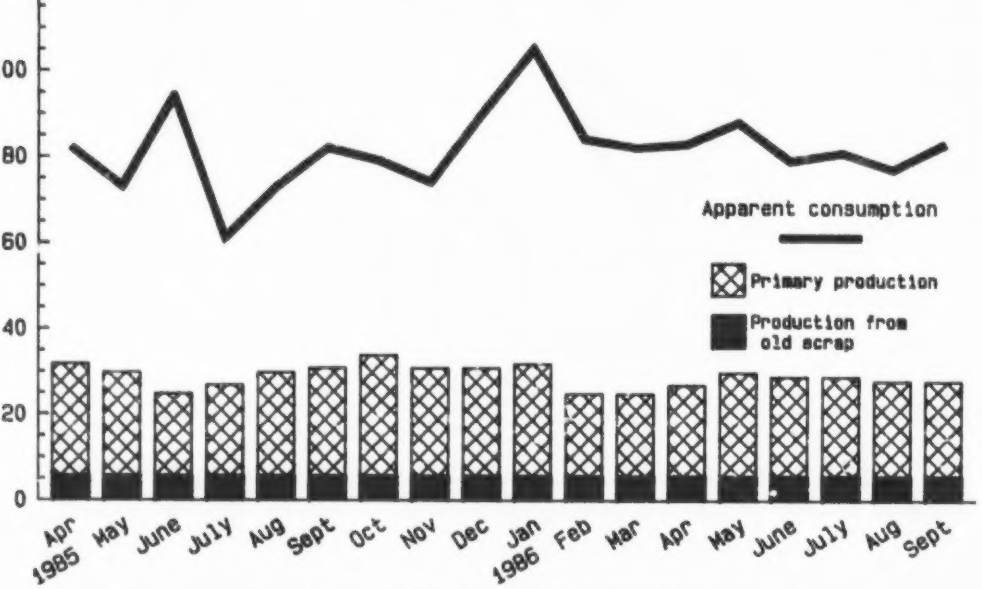
ZINC



Thousand mt contained metal, except as noted

Year / Month	Apparent consumption	Production: Primary[1]	Production: From old scrap[2]	Imports[3]	Exports[4]	Inventories: Private	Inventories: Government	Price (¢/lb)[5]
1981	1,000	397	86	620	35	195	341	44.6
1982	833	302	62	463	30	159	341	38.5
1983	988	305	76	625	29	148	341	41.4
1984	1,027	331	81	645	40	138	341	48.6
1985	976	312	74	616	45	119	341	40.4
1985: Apr	82	26	6	53	4	109	341	44.9
May	73	24	6	41	3	104	341	45.1
June	94	19	6	70	3	102	341	43.7
July	61	21	6	46	3	111	341	41.4
Aug	73	24	6	42	3	107	341	39.8
Sept	82	25	6	54	4	106	341	37.9
Oct	79	28	6	42	4	99	341	35.8
Nov	74	25	6	65	8	113	341	33.4
Dec	90	25	6	67	3	118	341	33.9
1986: Jan	105	26	6	75	4	116	341	32.9
Feb	84	19	6	59	5	111	341	30.9
Mar	82	19	6	58	5	107	341	31.2
Apr	83	21	6	50	6	95	341	32.1
May	88	24	6	54	6	85	341	33.0
June	79	23	6	41	5	71	341	36.5
July	81	23	6	62	7	74	341	39.5
Aug[e]	77	22	6	60	5	80	341	40.8
Sept[e]	83	22	6	65	5	85	341	43.7

Apparent consumption = primary production + production from old scrap + (imports - exports) + (beginning inventories - ending inventories).

See footnotes at end of section.
Data prepared October 23, 1986.

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GENERAL NOTES

Numbers in the mineral data series are from the Bureau of Mines, except for imports and exports (Bureau of the Census) and Government inventories (General Services Administration), or as cited in the footnotes below. Inventory figures are for the end of the period.

Monthly figures are independently rounded. They exclude year-end revisions and may not add to monthly apparent consumption annual totals.

Footnotes Used

e/ = Estimate   p/ = Preliminary   r/ = Revised   W = Withheld   NA = Not available

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FOOTNOTES, BY COMMODITY

ALUMINUM

1 Aluminum metal consumption only. Nonmetallic uses of bauxite and alumina in chemical, abrasive, and refractory materials represent, on an aluminum metal equivalent, an additional 10% apparent industrial demand.

2 Source: U.S. Department of Commerce.

3 Primary producers' list prices. Annual figures are Bureau of Mines averages. Monthly figures are producers' list prices as quoted by Metals Week. The average market or spot prices quoted by Metals Week were 54.5¢/lb for August and 55.4¢/lb for September.

Note: As of the December 1985 / January 1986 issue, aluminum data are presented in metric tons rather than short tons. To convert metric tons to short tons, multiply by 1.10231.

CHROMIUM

1 Before January 1984: in alloys, by metallurgical industry, and in chromite, by refractory and chemical industries. Since January 1984: in alloys, by metallurgical industry, and in chromite, by metallurgical, chemical, and refractory industries. Estimates do not include yield losses in production or make adjustments for an incomplete industry survey.

2 Estimated chromium content of stainless steel scrap received by steel industry.

3 Chromium content of chromite and chromium alloys.

4 Producer and consumer inventories of alloys and metal and consumer inventories of ores.

5 Chromium contained in specification-grade chromite, chomium ferroalloys, and chromium metal.

6 Transvaal ore, f.o.b. South Africa.

COBALT

1 Reported consumption of purchased scrap.

2 Content of unwrought cobalt, cobalt alloys, and waste and scrap.

3 End-of-month stocks at processor and consumer establishments only for monthly data.

4 Weighted average based on weekly price quoted by Metals Week.

5 Estimated as consigned to the stockpile based on import data.

6 Apparent consumption figure does not reflect change in Government inventory; this change represents acceptance of imports that occurred prior to 1984.

7 Import figure does not include quantity of cobalt destined for stockpile.

8 Due to minor adjustments in calculation of private inventories, apparent consumption for year 1984 is not based on 1983 stock data.

COPPER

1 Refined metal and metal used in production of alloys, from domestic and foreign ores, and old scrap.

2 Unwrought refined copper.

3 Refined copper held at primary producers' plants, wire mills, brass mills, chemical plants, foundries, and miscellaneous plants, and in Commodity Exchange, Inc. warehouses.

4 U.S. producers delivered price, listed as "U.S. Producer Cathode" in Metals Week. Revised from previous quotes for wirebar.

Note: Revised as of April/May 1984 issue to delete scrap from import and export figures.

IRON ORE

1 Data estimated except for annual mine production.

2 Based on gross weights reported by American Iron Ore Association.

3 Calculated from data reported to Bureau of Mines by U.S. producers.

4 Includes usable ore reported at U.S. mines, docks, and consuming plants, end of month. After 1982, excluding byproduct ore at mines. Prior data unchanged for proprietary reasons.

5 Based on published end-of-month prices for Lake Superior iron ore pellets, delivered rail-of-vessel at lower Great Lakes ports, per LTU of iron, natural basis.

6 Due to adjustment of mine stocks (see footnote 4), apparent consumption for year 1983 is not based on December 1982 stock data.

LEAD

1 Monthly canvass adjusted to reflect annual canvass and exclude approximately 7% new scrap.

MANGANESE

1 Manganese contained in manganiferous ore.

2 Includes manganese dioxide as of 1984.

3 Producer and consumer inventories of alloys and metal and consumer inventories of ores.

4 Average price per LTU, metallurgical ore containing 46% to 48% manganese.

5 Reflects inventory adjustments.

6 Adjusted for reexports.

NICKEL

1 Primary nickel.

2 Contained nickel in ferronickel.

3 Estimated. Includes new and old scrap.

4 Exports of unwrought nickel, powder, flakes, and electrolytic anodes.

5 U.S. producer and producer's agent stocks.

6 Producer listed price of cathode nickel; yearly weighted average. Spot prices of cathode nickel; weighted average annual and monthly prices.

PLATINUM-GROUP METALS

1 Refined metal.

2 Non-tolled scrap. Breakdown between old and new scrap not available.

3 Refined metal and scrap metal.

4 Refined metal held by refiners, importers, dealers. Includes platinum and palladium in New York Mercantile Exchange warehouses.

5 Quarterly and annual averages of weekly major-producer prices.

STEEL

1 Not including iron and steel foundry products.

2 American Iron and Steel Institute (AISI).

3 Compiled by AISI from Bureau of the Census reports.

4 Steel mill shapes and forms, reported by Bureau of the Census.

5 Includes steel in process and finished steel.

6 Average composite price of finished steel, reported in Iron Age.

7 Revised series beginning in 1983.

8 Revised series beginning in 1985.

TITANIUM METAL

1 Calculated sponge metal production = sponge consumption - sponge imports + exports and adjustments for Government and industry stock changes.

2 Usually over 75% scrap.

3 End-of-period list price for sponge through 1985; estimated sales price range in 1986. Actual sales prices from 1982 through 1985 were mainly in a range of $3.50/lb to $4.50/lb.

4 Excludes sponge imported by GSA for the Strategic Stockpile.

5 Not included in calculations of apparent consumption.

ZINC

1 Monthly production figures reported by American Bureau of Metal Statistics, Inc. (ABMS) do not include all data from companies reporting annually to Bureau of Mines.

2 Monthly old scrap figures based on a percentage of the total secondary zinc produced during the month.

3 Imports for consumption of slab zinc, fume, dross, and skimming.

4 Consists of unwrought zinc, zinc content of waste, and scrap and dross.

5 Metals Week monthly average price for High Grade zinc.

CURRENT BUREAU OF MINES PUBLICATIONS OF SPECIAL INTEREST

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INFORMATION CIRCULARS

IC 9070. Gold Availability—World. A Minerals Availability Appraisal, by Paul R. Thomas and Edward H. Boyle, Jr. 1986. 87 pp. 37 figs. The Bureau of Mines evaluated the long-term cost and availability of primary gold production from 135 mines and deposits worldwide. Collectively, the evaluated countries represent 93 pct of world gold production. Total recoverable gold available (as of January 1984) from a subset of 111 significant producing mines and developing deposits in 13 market economy countries (MEC's) is estimated at 810 million tr oz. The Republic of South Africa is estimated to account for 87 pct of total recoverable gold. The United States and Canada account for 4 and 4.5 pct of the total, respectively. Eighty-three percent of total recoverable gold is available at a constant 1984 break-even price of $400/tr oz, and 70 pct is available at $300/tr oz. South Africa accounts for 90 pct of the gold available at $400/tr oz or less. Major conclusions are that (1) South Africa should remain the largest world producer through the year 2000, (2) annual MEC output in 2000 should not be significantly different than current output given constant 1984 gold prices of more than $300/tr oz, and (3) there may be a significant decline in production after 2010 in the absence of major new discoveries and continued development of new mines to offset the depletion of the South African mines. GPO Stock No. 024-004-02164-1. $4.50.

INFORMATION CIRCULAR

IC 9081. Thermodynamic Properties of Selected Metal Sulfates and Their Hydrates, by Carroll W. DeKock. 1986. 59 pp. Thermodynamic data for selected metal sulfates were critically evaluated and compiled as part of the Bureau of Mines program to provide a scientific base for use in developing new technology and predicting the feasibility of new processes. Values for Cp°, S°, $H^\circ - H^\circ_{298}$, $-(G^\circ - H^\circ_{298})/T$, ΔHf°, ΔGf°, and log Kf as functions of temperature are given in tabular form. Thermodynamic data were compiled for Ag_2SO_4, $Al_2(SO_4)_3$, $Al_2(SO_4)_3 \cdot 6H_2O$, $BaSO_4$, $BeSO_4$, $BeSO_4 \cdot 2H_2O$, $BeSO_4 \cdot 4H_2O$, $CaSO_4$, $CaSO_4 \cdot 1/2H_2O$, $CaSO_4 \cdot 2H_2O$, $CdSO_4$, $CdSO_4 \cdot H_2O$, $CdSO_4 \cdot 8/3H_2O$, $2CdO \cdot CdSO_4$, Cs_2SO_4, $In_2(SO_4)_3$, K_2SO_4, $KAl(SO_4)_2$, $KAl(SO_4)_2 \cdot 12H_2O$, Li_2SO_4, $Li_2SO_4 \cdot H_2O$, $MgSO_4$, $MgSO_4 \cdot H_2O$, $MgSO_4 \cdot 2H_2O$, $MgSO_4 \cdot 4H_2O$, $MgSO_4 \cdot 6H_2O$, $MgSO_4 \cdot 7H_2O$, Na_2SO_4, $Na_2SO_4 \cdot 7H_2O$, $Na_2SO_4 \cdot 10H_2O$, $(NH_4)_2SO_4$, $NH_4Al(SO_4)_2$, $NH_4Al(SO_4)_2 \cdot 12H_2O$, $PbSO_4$, Rb_2SO_4, Tl_2SO_4, and $Zr(SO_4)_2$. GPO Stock No. 024-004-02168-3. $3.25.

IC 9082. Mineral Consumption Forecasting: Standardizing and Comparing Forecasts, by John B. Bennett. 1986. 17 pp. 2 figs. This Bureau of Mines report presents a method of standardizing forecasts of mineral consumption that attempts to resolve the problems caused by the use of different data bases, different definitions of minerals consumption, and different base years for making projections. Using this method, forecasts of U.S. and world mineral consumption, in the year 2000, for nine commodities (aluminum, chromium, cobalt, copper, manganese, nickel, tin, tungsten, and zinc) are standardized and compared. Also, selected forecasts or associated growth rates are used to generate implied values of consumption for 1980–83, which are then compared with actual values of consumption for 1980–83. The economic growth predictions underlying these forecasts are examined, and some general conclusions are drawn. A description of each methodology used to generate these forecasts is given in an appendix. GPO Stock No. 024-004-02165-9. $1.50.

MINERALS YEARBOOK, 1984

Volume II. Area Reports: Domestic, prepared by the staff of the Bureau of Mines. 1986. 52 ch. 669 pp. This volume of the 1984 Minerals Yearbook contains chapters on the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, and the Commonwealth of Puerto Rico. A statistical summary is also included in this volume. GPO Stock No. 024-004-02163-2. $24.

BULLETIN

B 680. Investigation of Fire and Explosion Accidents in the Chemical, Mining, and Fuel-Related Industries—A Manual, by Joseph M. Kuchta. 1986. 84 pp. 87 figs. This Bureau of Mines manual is oriented to the technical needs of an investigation of fire or explosion accidents and includes various practical and theoretical information that is needed in analyzing accidents or evaluating conditions that might lead to an accident. It is applicable to accidents in the chemical, mining, transportation, and other fuel-related industries. Specific procedures for conducting an accident investigation are outlined, and various guidelines are given for developing the fire or explosion evidence. Ignitability, flammability, and physiochemical data are presented for over 500 combustible gases, liquids, and solids; empirical and theoretical expressions are also given for extrapolating the behavior of combustible-oxidant-diluent systems to various environmental conditions. In addition, various data pertinent to damage analysis are summarized to facilitate the task of the investigator in developing plausible accident scenarios. GPO Stock No. 024-004-02167-5. $4.50.

BULLETINS

B 684. Bureau of Mines Research on Recycling Scrapped Automobiles, by K. C. Dean, J. W. Sterner, M. B. Shirts, and L. J. Froisland. 1986. 46 pp. 31 figs. Discarded automobiles represent the greatest single resource of reusable metals, plastics, and rubber in the United States. This report presents results of Bureau of Mines research, conducted from 1965 to 1983, on separating and recovering useful materials from the scrapped hulks, using old and new metallurgical techniques combined with standard scrapyard methods. The Bureau determined the materials composition of three composite cars designated as circa 1960, mid-1970's and early 1980's, and used these cars to study smokeless incineration and hand-sorting techniques. In studies on treating rejects from automobile shredders, the Bureau designed a process that included air classification, water elutriation, magnetic separation, handpicking, and heavy-medium separation, and also investigated cryogenics and liquation. Complete recovery of copper and other metals was economically made by hand and tool dismantling, leaching, or selective melting of starters and generators. Techniques are also discussed for plastic recovery and waste tire treatment. GPO Stock No. 024-004-02166-7. $2.75.

B 686. The Citrate Process for Flue Gas Desulfurization, by W. I. Nissen, L. Crocker, L. L. Oden, and others. 1986. 69 pp. 47 figs. As part of its program to provide technology for reducing undesirable environmental impacts of mineral processing operations, the Bureau of Mines developed the citrate process for desulfurizing industrial stack gases that contain from 0.1 to 2 vol pct SO_2. In this regenerable flue gas desulfurization process, SO_2 is absorbed from cleaned and cooled industrial flue gas with a citric acid-sodium citrate solution. The absorbed SO_2 is subsequently reacted with H_2S to precipitate marketable elemental sulfur and regenerate the solution for recycle. Laboratory investigations of process parameters provided information for designing larger scale continuous operations. Information gathered from operation of two pilot plants, one at a copper smelter and one at a lead smelter, confirmed the laboratory results. Data were obtained for design and construction of a commercial-sized demonstration plant at the George F. Weaton Power Station, Monaca, PA. A preliminary operation of the plant was demonstrated under a cost-sharing Bureau-industry contract. This bulletin describes the citrate process and gives results of the laboratory, pilot plant, and demonstration plant studies, as well as corrosion investigations. GPO Stock No. 024-004-02169-1. $3.75.